

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART F REQUIREMENT

OF

Applicant: Catapult Sports Pty Ltd
75-83 High St, Prahran, Victoria, 3181, Australia
Product Name: Clearsky T6
Brand Name: Clearsky T6
Model No.: T6
Model Difference: N/A
Report Number: ER/2019/10084
FCC ID: 2ADAL-32322A
FCC Rule Part: §15.519, Cat: UWB
Issue Date: Oct. 14, 2019
Date of Test: Aug. 14, 2019 ~ Sep. 25, 2019
Date of EUT Received: Aug. 14, 2019

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

Tested By:



Nick Lin / Sr. Engineer

Approved By:



Blue Yang / Asst. Manager



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Revision History

Revision	Description	Issue Date	Remark
Rev.00	Original.	Sep. 26, 2019	Revised by: Tiffany Kao
Rev.01	Updated Section 10	Oct. 14, 2019	Revised by: Tiffany Kao

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1 GENERAL INFORMATION

1.1 Product description

Product Name:	Clearsky T6	
Brand Name:	Clearsky T6	
Model No.:	T6	
Model Difference:	N/A	
Hardware Version:	V2.8	
Software Version:	V5.0	
Charger:	Model No.: N/A, Supplier: N/A	
Power Supply:	3.7Vdc from Rechargeable Li-polymer Battery or 5Vdc from charger	
	Battery:	Model No.: YJ-PL502627, Supplier: YJ POWER GROUP LIMITED

Radio Technology:	Ultra Wide Band
Operating Band:	3774MHz ~ 4243.2MHz
Channel number:	1 channel
Modulation type:	BPSK
Transmit Power:	-0.76dBm
Antenna Designation:	Monopole Antenna, Gain: 2.2dBi

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.519

ANSI C63.10:2013

KDB 393764D01 UWB FAQ v02

Note: All test items have been performed and record as per the above standards.

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803 (TAF code 0513)

FCC Designation number: TW0001

1.4 Special Accessories

There is no special accessory used while test was conducted.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 µH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

2.3.3 Radiated Emissions

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission



Fig. 2-2 Conduction (AC Power Line) Radiated Emission

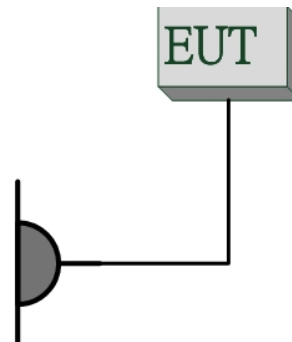


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	UWB Test Software	N/A	N/A	N/A	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Test Report Section	Result
§15.207(a)	AC Power Line Conducted Emission	6.6	Compliant
§15.519(b) §15.503 (d)	UWB bandwidth	7.5	Compliant
§15.209 §15.519(c) (d)	Radiated Emission below 960MHz and above 960MHz. Radiated Emissions in GPS bands. Average Emissions of UWB transmissions in a 1MHz Bandwidth	8.6 8.7 8.8	Compliant
§15.519(e)	Peak level of the Emission	8.5	Compliant
§15.519(a) (1)	Transmitter Timeout	9.5	Compliant

4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Test frequency 4000MHz is chosen for full testing.

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) the worst case E2 position was reported.

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
UWB Bandwidth	+/- 51.33 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

Radiated Spurious Emission Measurement Uncertainty	
Polarization: Vertical	9kHz~30MHz: +2.3dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB
Polarization: Horizontal	9kHz~30MHz: +2.3dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable

Frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note		
1.The lower limit shall apply at the transition frequencies		
2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

6.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI 3	100335	02/12/2019	02/11/2020
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2018	11/25/2019
LISN	SCHWARZBECK	NSLK 8127	8127-649	04/02/2019	04/01/2020
LISN	FCC	FCC-LISN-50/250-25 -2-01	4034	04/09/2019	04/08/2020
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R	N.C.R

6.3 EUT Setup

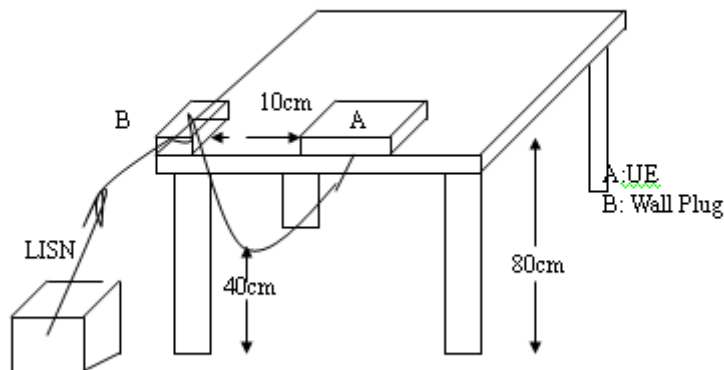
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plan.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

6.6 Measurement Result

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit.

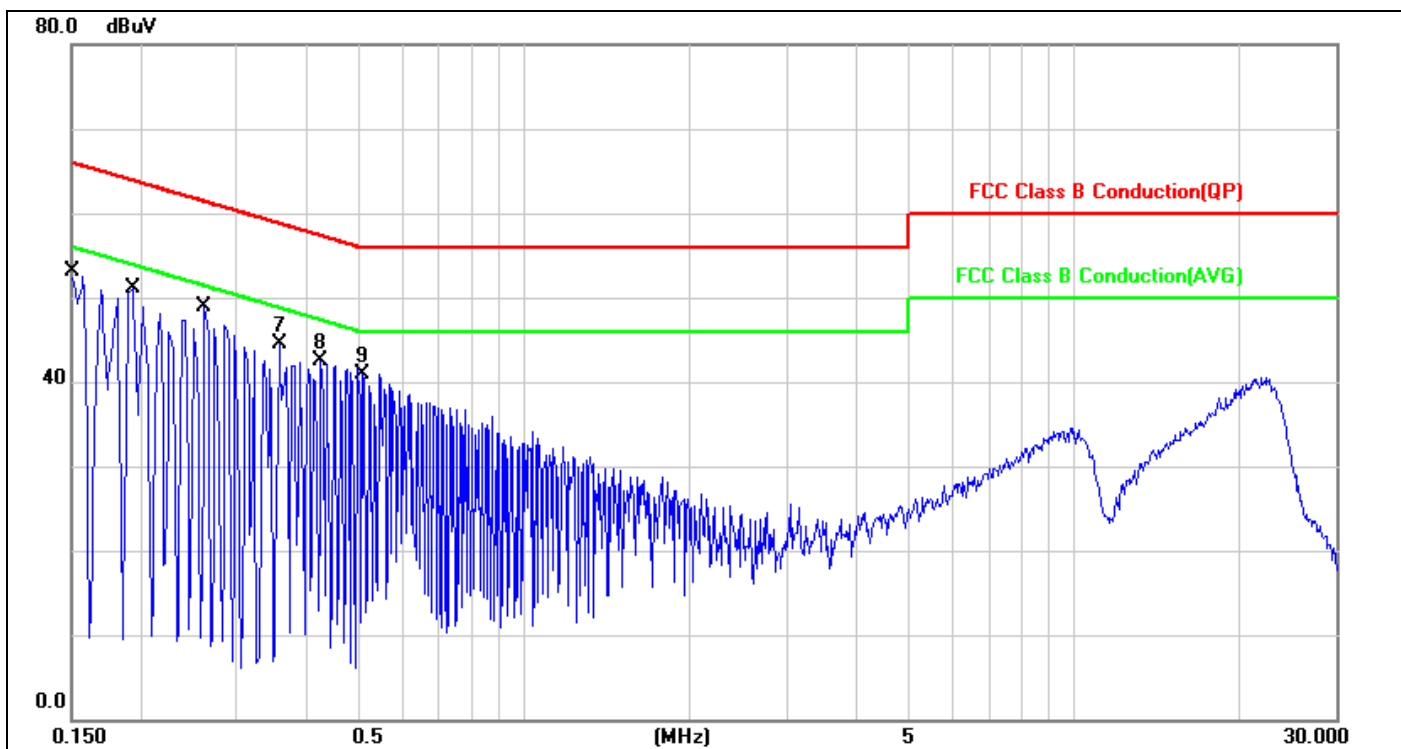
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Site:	1F Conduction Room	Date:	2019/9/19	Time:	下午 05:43:41
Limit:	FCC Class B Conduction(QP)	Probe:	L1	Temperature:	24°C
EUT:	EVO WRC TAG	Power:	AC 120V/60Hz	Humidity:	55%RH
M/N:	Optimeye T6			Air Pressure:	1012
Mode:	Operation(UWB)				
Note:	No.: ER-2019-10084				
Test by:	Nick				



No.	Mk.	Freq. (MHz)	Reading dBuV	Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Over (dB)	Detector	Comment
1		0.1500	40.80	0.00	40.80	66.00	-25.20	QP	
2		0.1500	24.30	0.00	24.30	56.00	-31.70	AVG	
3		0.1940	37.50	0.01	37.51	63.86	-26.35	QP	
4		0.1940	20.70	0.01	20.71	53.86	-33.15	AVG	
5		0.2620	39.90	0.01	39.91	61.37	-21.46	QP	
6		0.2620	16.50	0.01	16.51	51.37	-34.86	AVG	
7	*	0.3580	44.47	0.01	44.48	58.77	-14.29	peak	
8		0.4260	42.56	0.01	42.57	57.33	-14.76	peak	
9		0.5100	40.89	0.01	40.90	56.00	-15.10	peak	

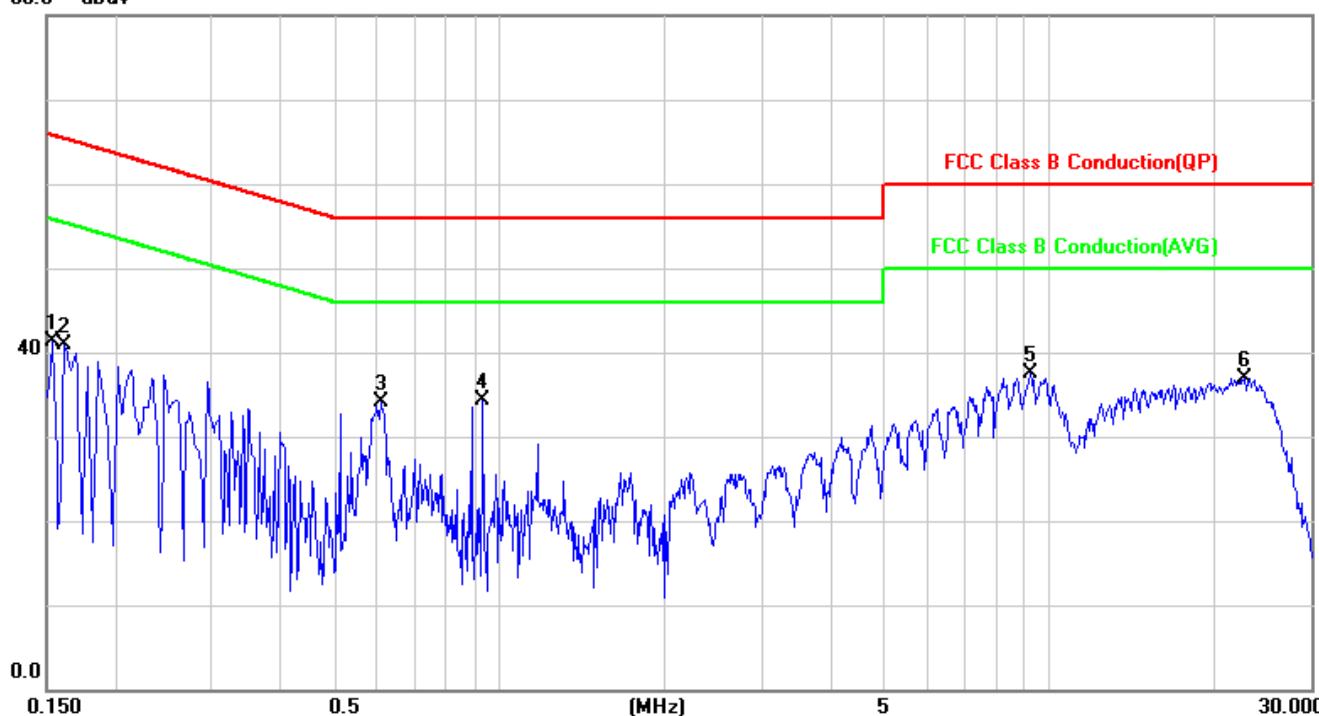
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Site:	1F Conduction Room	Date:	2019/9/19	Time:	下午 05:51:35
Limit:	FCC Class B Conduction(QP)	Probe:	N	Temperature:	24°C
EUT:	EVO WRC TAG	Power:	AC 120V/60Hz	Humidity:	55%RH
M/N:	Optimeye T6	Air Pressure:	1012		
Mode:	Operation(UWB)				
Note:	No.: ER-2019-10084				
Test by:	Nick				

80.0 dBuV



No.	Mk.	Freq. (MHz)	Reading dBuV	Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Over (dB)	Detector	Comment
1		0.1540	41.26	0.03	41.29	65.78	-24.49	peak	
2		0.1620	40.87	0.03	40.90	65.36	-24.46	peak	
3		0.6100	34.08	0.03	34.11	56.00	-21.89	peak	
4	*	0.9380	34.23	0.04	34.27	56.00	-21.73	peak	
5		9.2900	37.13	0.28	37.41	60.00	-22.59	peak	
6		22.7300	36.42	0.49	36.91	60.00	-23.09	peak	

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7 UWB BANDWIDTH

7.1 Standard Applicable

According to §15.519 (b) The UWB bandwidth of a device operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz

According to §15.503 (d) Ultra-wideband (UWB) transmitter. An intentional radiator that, at any point in time, 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

7.2 Measurement Equipment Used

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Bi-log Antenna	TESEO	CBL 6112D	35242 & AT-N0555	01/10/2019	01/09/2020
Horn Antenna	Schwarzbeck	BBHA9170	07/02/1900	12/27/2018	12/26/2019
Horn Antenna	Schwarzbeck	BBHA9120D	D803	12/24/2018	12/23/2019
3m Site NSA	SGS	966 chamber	N/A	01/02/2019	01/01/2020
Loop Antenna	ETS.LINDGREN	6502	148045	10/08/2018	10/07/2019
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/22/2019	04/21/2020
EMI Test Receiver	R&S	ESCI 3	100335	02/12/2019	02/11/2020
Pre-Amplifier	EMC Instruments	EMC184045B	980135	01/02/2019	01/01/2020
Pre-Amplifier	EMC Instruments	EMC051825	980152	01/02/2019	01/01/2020
Pre-Amplifier	HP	8447D	2944A09469	01/02/2019	01/01/2020
Pre-Amplifier	EMC Instruments	EMC12645	980119	06/09/2019	06/08/2020
Coaxial Cable	Huber Suhner	succoflex 102	MY2622/2	01/02/2019	01/02/2020
Coaxial Cable	Huber Suhner	succoflex 104A	800086/4a	01/02/2019	01/02/2020
Coaxial Cable	Huber Suhner	EMC 104-SM-SM-2000	160123	01/02/2019	01/02/2020
Software	e3 V6.11-2018041301/09/2020				

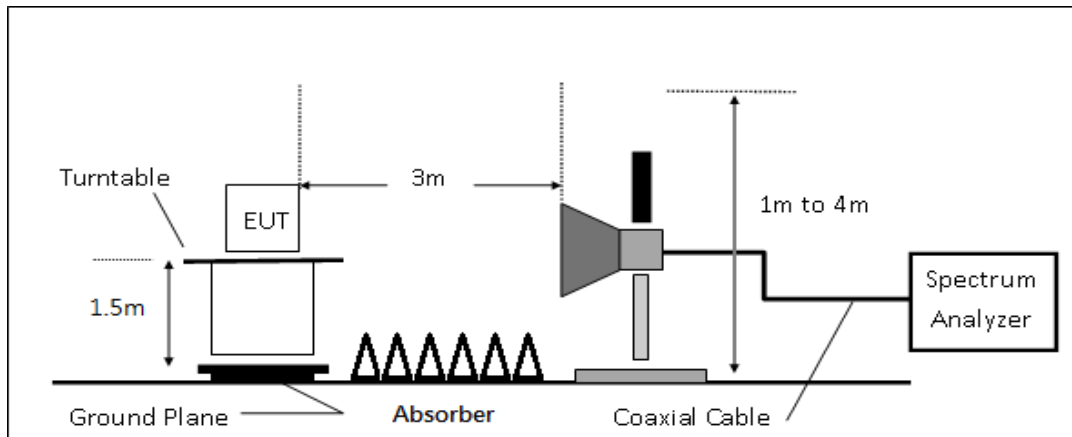
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7.3 Test Set-up:

(A) Radiated Emission Test Set-UP Frequency for 3 meter



7.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum. RBW = 1MHz, VBW = 3MHz, Span: 1GHz, Detector =peak, Sweep = Auto.
3. Record the max. Reading as observed from Spectrum.
4. Repeat above procedures until all test default channel measured was complete.

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7.5 Measurement Result:



Bandwidth Results					
Antenna Polarity	Frequency 10dB below peak (MHz)	Frequency 10dB above peak (MHz)	10 dB bandwidth (MHz)	Bandwidth requirement >500 MHz	Detectors / RBW / VBW
Horizontal	3680	4277	597	Compliant	RMS 1MHz / 3MHz

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8 RADIATED EMISSION AND PEAK LEVEL OF THE EMISSION

8.1 Standard Applicable

According to §15.519(c), 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 § 15.209. 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:

Frequency in MHz	EIRP in dBm
960–1610	– 75.3
1610–1990	– 63.3
1990–3100	– 61.3
3100–10600	– 41.3
Above 10600	– 61.3

§15.519 (d), In addition to the radiated emission limits specified in the table in paragraph (c) 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 in MHz	EIRP in dBm
1164–1240	– 85.3
1559–1610	– 85.3

§15.519 (e), 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, fM. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in § 15.521.

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8.2 Measurement Equipment Used

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Bi-log Antenna	TESEO	CBL 6112D	35242 & AT-N0555	01/10/2019	01/09/2020
Horn Antenna	Schwarzbeck	BBHA9170	07/02/1900	12/27/2018	12/26/2019
Horn Antenna	Schwarzbeck	BBHA9120D	D803	12/24/2018	12/23/2019
3m Site NSA	SGS	966 chamber	N/A	01/02/2019	01/01/2020
Loop Antenna	ETS.LINDGREN	6502	148045	10/08/2018	10/07/2019
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/22/2019	04/21/2020
EMI Test Receiver	R&S	ESCI 3	100335	02/12/2019	02/11/2020
Pre-Amplifier	EMC Instruments	EMC184045B	980135	01/02/2019	01/01/2020
Pre-Amplifier	EMC Instruments	EMC051825	980152	01/02/2019	01/01/2020
Pre-Amplifier	HP	8447D	2944A09469	01/02/2019	01/01/2020
Pre-Amplifier	EMC Instruments	EMC12645	980119	06/09/2019	06/08/2020
Coaxial Cable	Huber Suhner	succoflex 102	MY2622/2	01/02/2019	01/02/2020
Coaxial Cable	Huber Suhner	succoflex 104A	800086/4a	01/02/2019	01/02/2020
Coaxial Cable	Huber Suhner	EMC 104-SM-SM-2000	160123	01/02/2019	01/02/2020
Software	e3 V6.11-2018041301/09/2020				

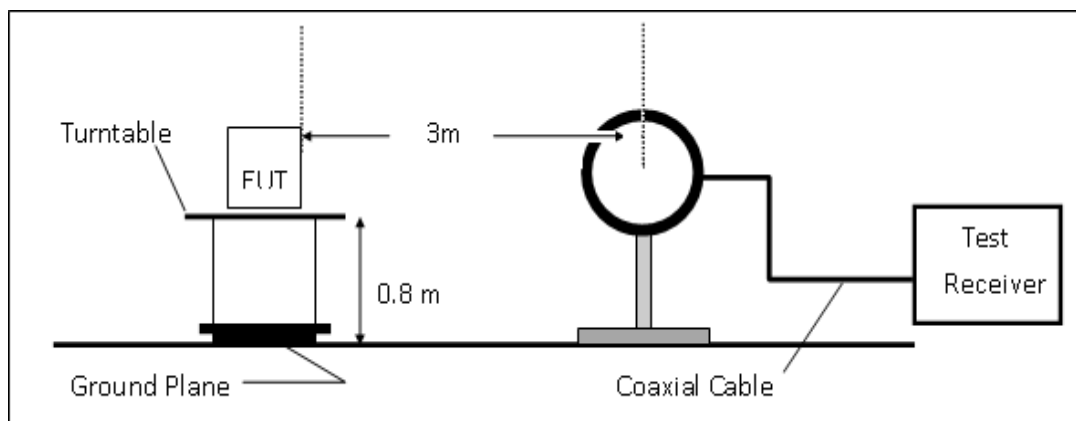
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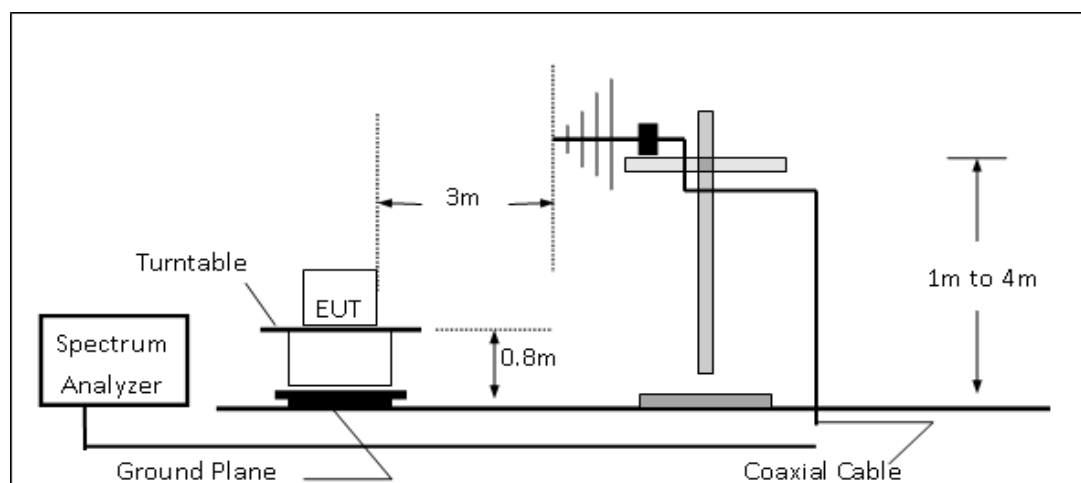
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8.3 Test Set-up

(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(B) Radiated Emission Test Set-Up, Frequency below 960MHz.

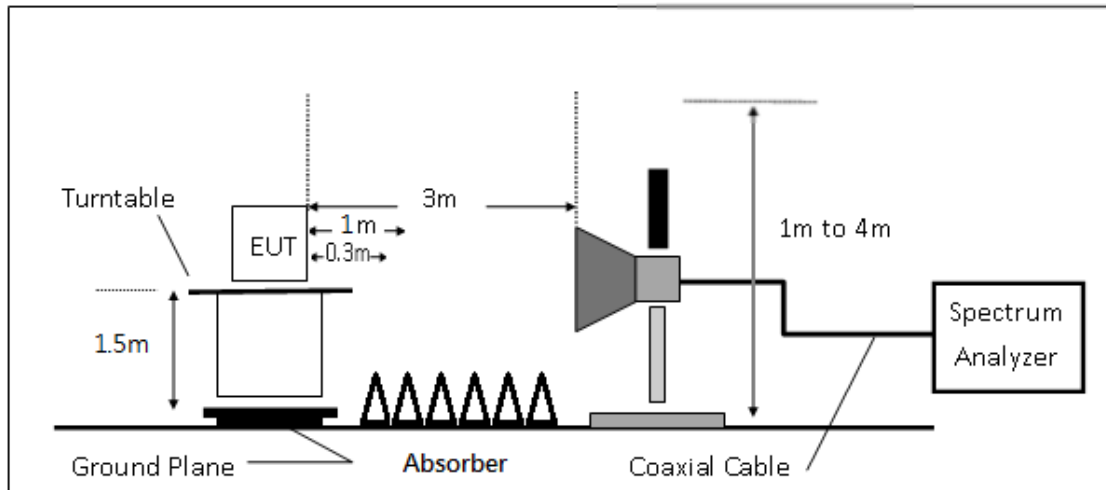


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(C) Radiated Emission Test Set-UP Frequency above 960MHz for 3 and 1 and 0.3 meter



A measurement distance of 1 meter and 0.3 meter was determined to provide the optimum dynamic range. Because the limits are so low, some frequency ranges may have been scanned at a distance closer than 1 meter and 0.3 meter.

8.4 Measurement Procedure

1. The testing follows the Measurement Procedure of ANSI C63.10:2013.
2. The EUT was placed on a turn table with 0.8m for frequency < 1GHz and 1.5m for frequency > 1GHz above ground plan.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions for 100 kHz to 30MHz, 30 MHz to 960MHz, 960MHz to 1GHz radiated emissions.
5. EUT is set 1m and 0.3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions for 1GHz to 10GHz, 10GHz to 18GHz, 18GHz to 40GHz radiated emissions.
6. Set the spectrum analyzer as RBW=200 Hz and VBW=2 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency 100kHz~30MHz.
7. Set the spectrum analyzer as RBW=100 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency 30MHz~960MHz and 960MHz~1GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.

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9. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for RMS Detector for Average emissions of UWB transmission in a 1MHz bandwidth.
10. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
11. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
12. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
13. Sweep the frequency to determine spurious emission as seen on spectrum from span of, 960MHz to 1GHz, 1GHz to 10GHz, 10GHz to 18GHz, 18GHz to 40GHz.
14. Via Software, combine 4 spans of frequency range into one plot.
15. Repeat above procedures until all default test channel measured were complete.

Note:

$$\text{EIRP(dBm)} = \text{Spectrum} + \text{Factor} - 95.2$$

Limit calculated as follows(RBW = 1MHz)

$$20 \log (\text{RBW}/50) \text{ dBm} = 2 \log (1/50) \text{ dBm} = -33.98 \text{ dBm}$$

$$\text{PeakE-filed (3m) E(dBuV/m)} = \text{P (dBm EIRP)} + 95.2 = -33.98 + 95.2 = 61.2 \text{ dBuV/m}$$

Note:

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) was not reported.

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8.5 Measurement Result

Peak level of the Emission Measurement Result

EIRP Peak at 3 Meter

Report Number	:ER-2019-10084	Test Date	:2019-09-25
Operation Mode	:UWB	Temp./Humi.	:23.1/59
Test Channel	:4000 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Main CH Low	Engineer	:Nick
EUT Pol	:E2 Plane		

Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS
MHz	PK/QP/AV	dBμV	dB	dBμV/m
4149.00	Peak	48.08	11.74	59.82

Note:

Bandwidth Correction Factor (BWCF) = $20 \log (1\text{MHz}/50\text{MHz}) = -33.98 \text{ [dB]}$

EIRP_1MHz[dBm] = E-Field [dBuV/m] - 95.2

EIRP_50MHz[dBm] = EIRP_1MHz[dBm] – BWCF

Frequency (MHz)	Detector Function	Antenna Polarity	BWCF (dB)	EIRP_1MHz Reading Level (dBμV/m)	EIRP_50MHz Reading Level (dBμV/m)	EIRP_50MHz Reading Level (dBm)	EIRP_50MHz Limit (dBm)	Margin (dBm)
4000	Peak	VERTICAL	-33.98	59.82	93.80	-1.40	0	-1.40

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Report Number	:ER-2019-10084	Test Date	:2019-09-25
Operation Mode	:UWB	Temp./Humi.	:23.1/59
Test Channel	:4000 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Main CH Low	Engineer	:Nick
EUT Pol	:E2 Plane		

Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m
4069.00	Peak	48.91	11.55	60.46

Note:

Bandwidth Correction Factor (BWCF) = $20 \log (1\text{MHz}/50\text{MHz}) = -33.98 \text{ [dB]}$

EIRP_1MHz[dBm] = E-Field [dBuV/m] - 95.2

EIRP_50MHz[dBm] = EIRP_1MHz[dBm] – BWCF

Frequency (MHz)	Detector Function	Antenna Polarity	BWCF (dB)	EIRP_1MHz Reading Level (dBμV/m)	EIRP_50MHz Reading Level (dBμV/m)	EIRP_50MHz Reading Level (dBm)	EIRP_50MHz Limit (dBm)	Margin (dBm)
4000	Peak	HORIZONTAL	-33.98	60.46	94.44	-0.76	0	-0.76

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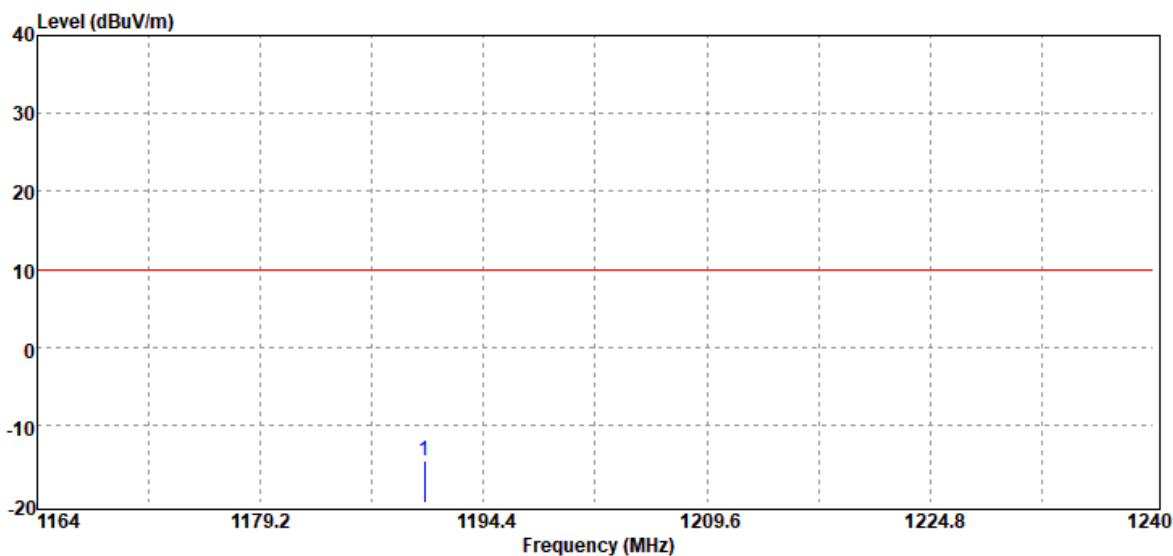
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8.6 Radiated Emission in GPS bands Measurement Result

GPS receive band (1164-1240MHz) at 1 Meter

Report Number	:ER-2019-10084	Test Date	:2019-09-20
Operation Mode	:UWB	Temp./Humi.	:23.1/59
Test Channel	:4000 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Tx CH Low	Engineer	:Nick
EUT Pol	:E2 Plane		



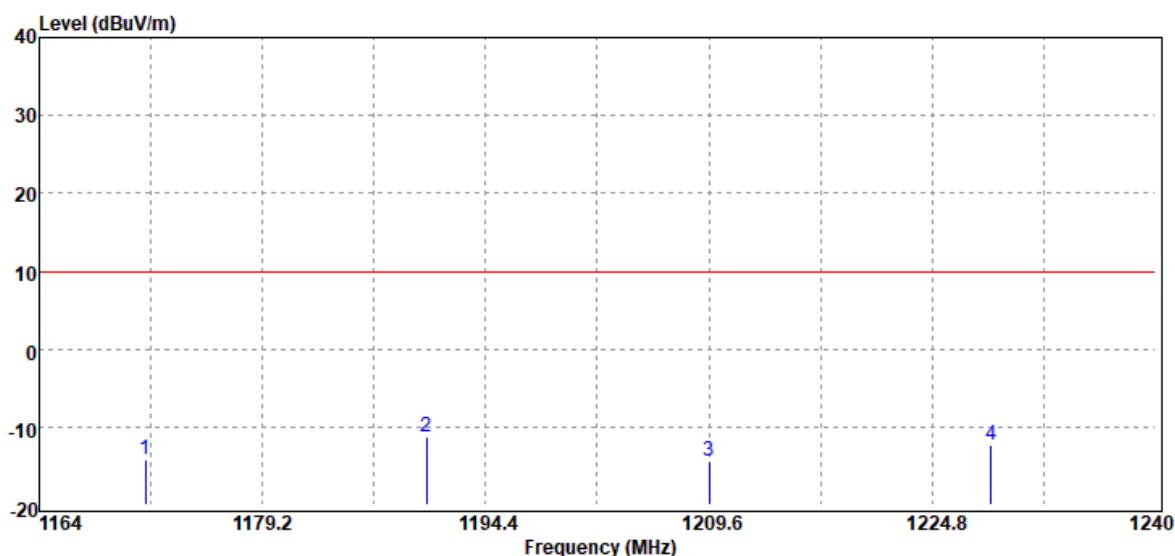
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Actual FS dBm	Limit @3m dBuV/m	Limit @3m dBm	Margin dB
1190.37	Peak	-16.61	1.98	-14.63	-109.83	9.90	-85.30	-24.53

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Report Number	:ER-2019-10084	Test Date	:2019-09-20
Operation Mode	:UWB	Temp./Humi.	:23.1/59
Test Channel	:4000 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Tx CH Low	Engineer	:Nick
EUT Pol	:E2 Plane		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Actual FS dBm	Limit @3m dBμV/m	Limit @3m dBm	Margin dB
1171.22	Peak	-16.06	1.95	-14.11	-109.31	9.90	-85.30	-24.01
1190.37	Peak	-13.28	1.98	-11.30	-106.50	9.90	-85.30	-21.20
1209.60	Peak	-16.53	2.10	-14.43	-109.63	9.90	-85.30	-24.33
1228.83	Peak	-14.55	2.32	-12.23	-107.43	9.90	-85.30	-22.13

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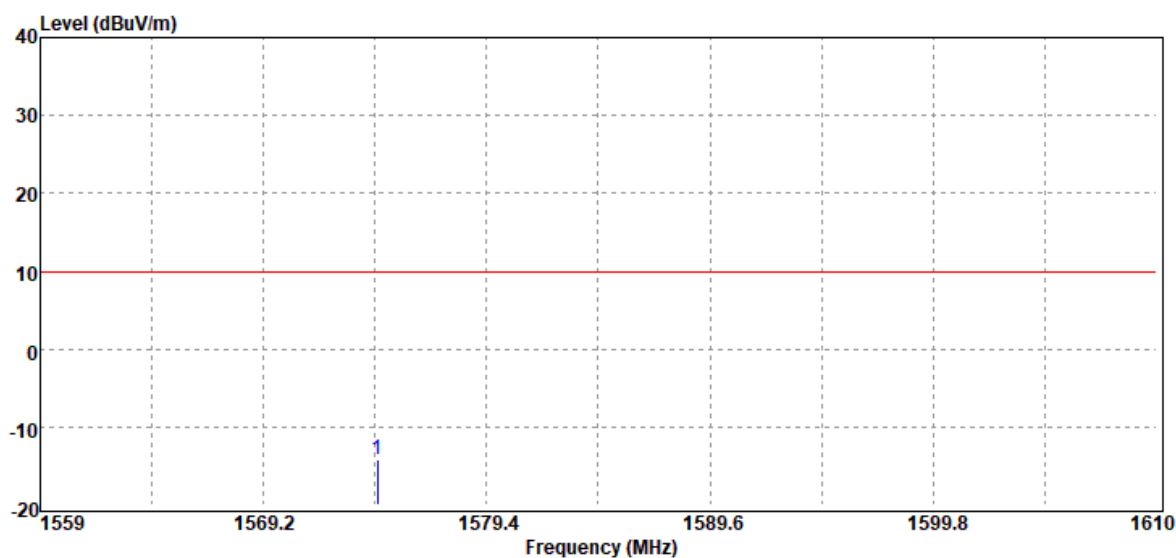
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GPS receive band (1559-1610MHz) at 1 Meter

Report Number :ER-2019-10084
 Operation Mode :UWB
 Test Channel :4000 MHz
 Test Mode :Tx CH Low
 EUT Pol :E2 Plane

Test Date :2019-09-20
 Temp./Humi. :23.1/59
 Antenna Pol. :VERTICAL
 Engineer :Nick



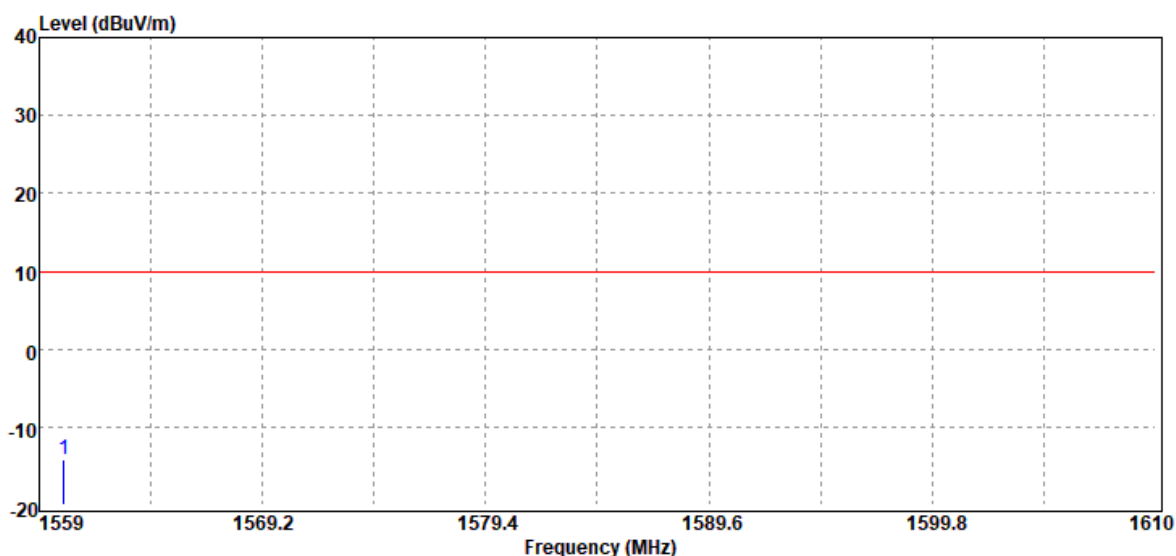
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Actual FS dBm	Limit @3m dBuV/m	Limit @3m dBm	Margin dB
1574.40	Peak	-16.96	2.76	-14.20	-109.40	9.90	-85.30	-24.10

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Report Number	:ER-2019-10084	Test Date	:2019-09-20
Operation Mode	:UWB	Temp./Humi.	:23.1/59
Test Channel	:4000 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Tx CH Low	Engineer	:Nick
EUT Pol	:E2 Plane		



Freq. MHz	Detector Mode	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Actual FS dBm	Limit @3m dB μ V/m	Limit @3m dBm	Margin dB
1560.12	Peak	-16.98	2.77	-14.21	-109.41	9.90	-85.30	-24.11

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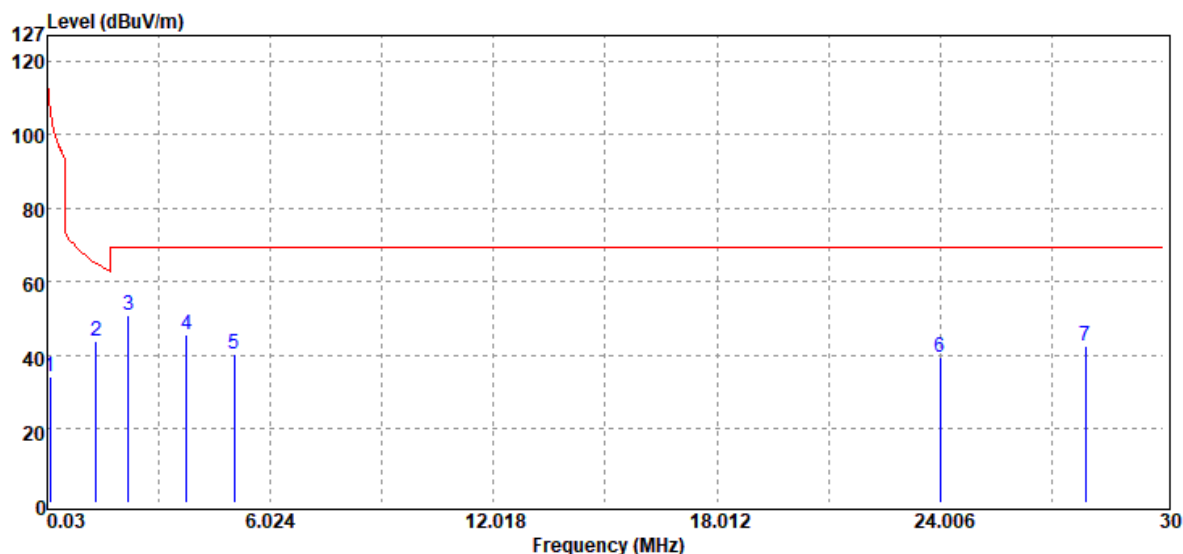
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8.7 Radiated Spurious Emission Measurement Result (§15.209 & §15.519)

Below 1GHz at 3 Meter

Report Number	:ER-2019-10084	Test Date	:2019-09-19
Operation Mode	:UWB	Temp./Humi.	:23.1/59
Test Channel	:4000 MHz	Antenna Pol.	:VERTICAL
Test Mode	:Tx CH Low	Engineer	:Nick
EUT Pol	:E2 Plane		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
0.11	Peak	34.28	0.18	34.46	106.91	-72.45
1.34	Peak	43.70	0.34	44.04	65.04	-21.00
2.21	Peak	50.46	0.37	50.83	69.54	-18.71
3.76	Peak	45.45	0.40	45.85	69.54	-23.69
5.05	Peak	39.89	0.42	40.31	69.54	-29.23
24.00	Peak	39.12	0.56	39.68	69.54	-29.86
27.91	Peak	42.06	0.55	42.61	69.54	-26.93

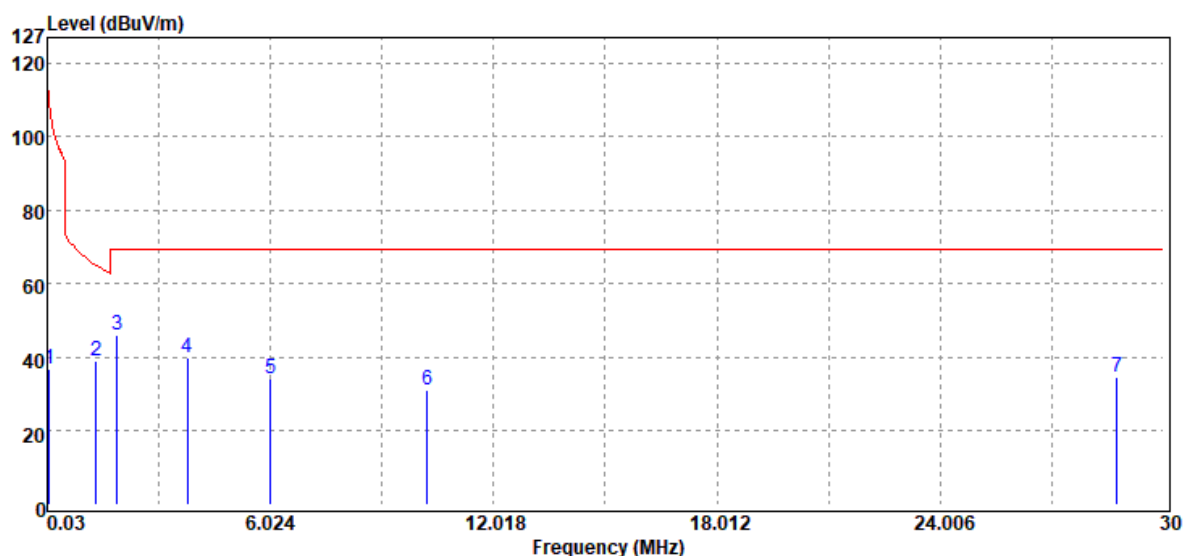
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Report Number :ER-2019-10084
Operation Mode :UWB
Test Channel :4000 MHz
Test Mode :Tx CH Low
EUT Pol :E2 Plane

Test Date :2019-09-19
Temp./Humi. :23.1/59
Antenna Pol. :HORIZONTAL
Engineer :Nick



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
0.07	Peak	36.72	0.15	36.87	110.16	-73.29
1.34	Peak	38.77	0.34	39.11	65.04	-25.93
1.91	Peak	45.66	0.36	46.02	69.54	-23.52
3.79	Peak	39.54	0.40	39.94	69.54	-29.60
6.03	Peak	33.79	0.43	34.22	69.54	-35.32
10.24	Peak	30.92	0.47	31.39	69.54	-38.15
28.75	Peak	33.96	0.55	34.51	69.54	-35.03

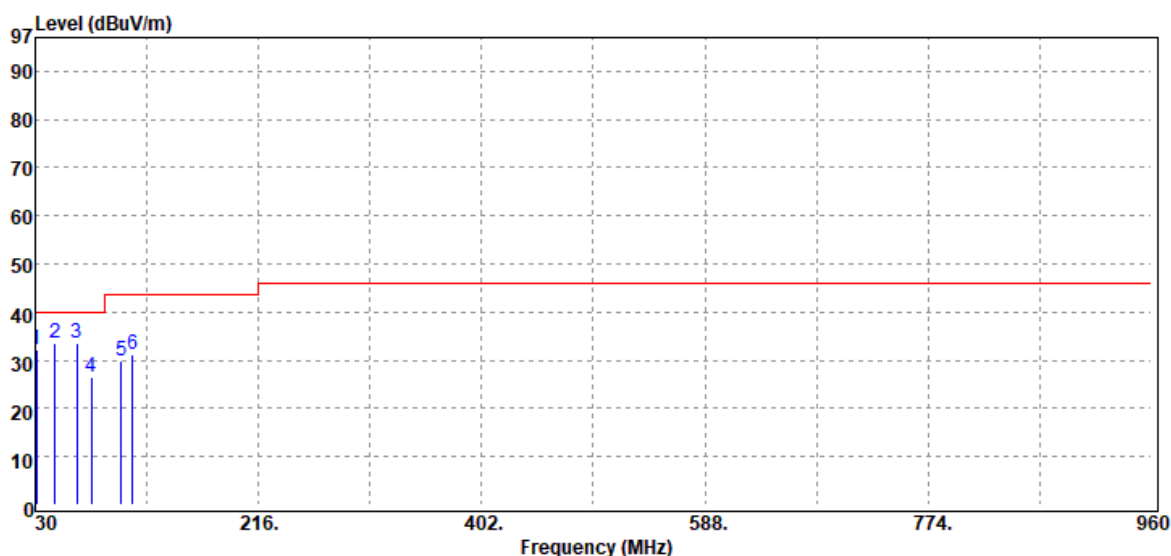
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Report Number :ER-2019-10084
Operation Mode :UWB
Test Channel :4000 MHz
Test Mode :Tx CH Low
EUT Pol :E2 Plane

Test Date :2019-09-18
Temp./Humi. :23.1/59
Antenna Pol. :VERTICAL
Engineer :Nick



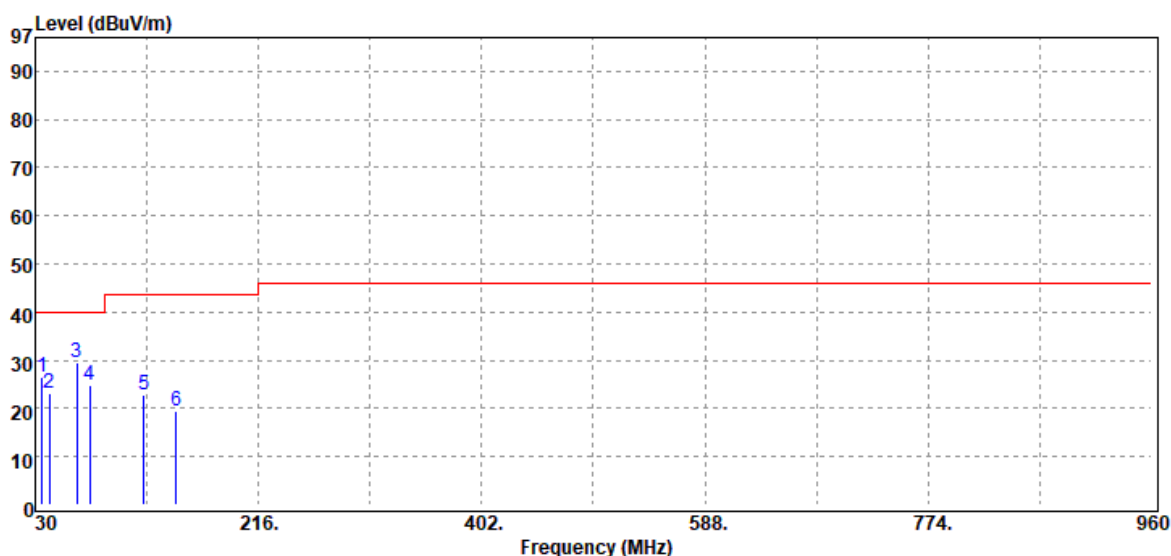
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
30.93	Peak	36.86	-4.51	32.35	40.00	-7.65
46.74	Peak	47.00	-13.52	33.48	40.00	-6.52
64.41	Peak	50.92	-17.38	33.54	40.00	-6.46
76.50	Peak	43.32	-16.70	26.62	40.00	-13.38
101.61	Peak	42.12	-12.27	29.85	43.50	-13.65
110.91	Peak	42.77	-11.63	31.14	43.50	-12.36

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Report Number	:ER-2019-10084	Test Date	:2019-09-18
Operation Mode	:UWB	Temp./Humi.	:23.1/59
Test Channel	:4000 MHz	Antenna Pol.	:HORIZONTAL
Test Mode	:Tx CH Low	Engineer	:Nick
EUT Pol	:E2 Plane		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
35.58	Peak	33.70	-7.10	26.60	40.00	-13.40
42.09	Peak	34.15	-11.00	23.15	40.00	-16.85
64.41	Peak	46.81	-17.38	29.43	40.00	-10.57
75.57	Peak	41.57	-16.74	24.83	40.00	-15.17
120.21	Peak	34.09	-11.19	22.90	43.50	-20.60
147.18	Peak	31.38	-12.02	19.36	43.50	-24.14

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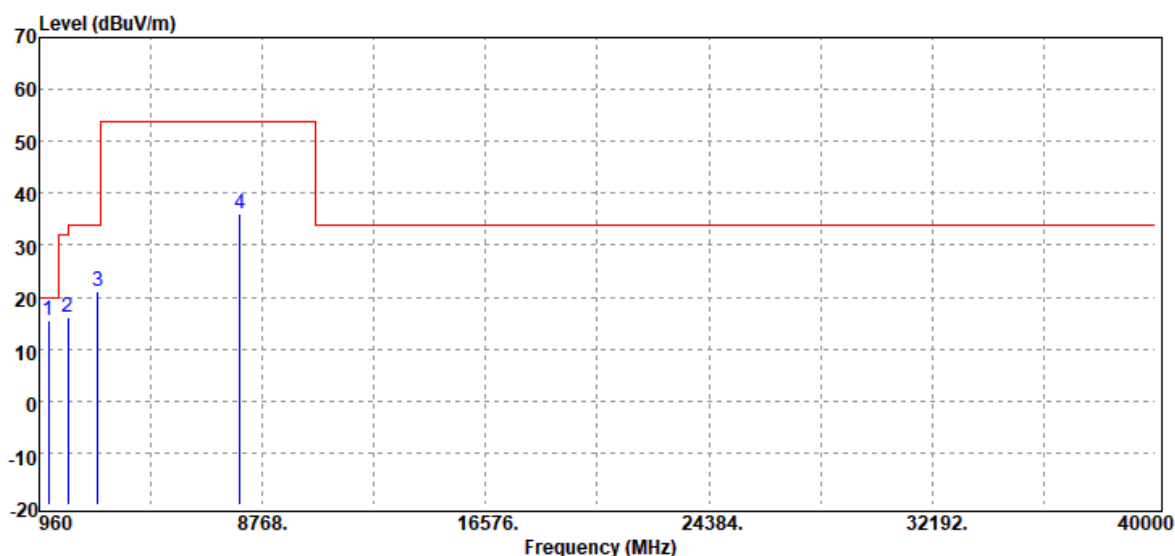
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1GHz to 10GHz and 10GHz to 18GHz at 1 Meter

18GHz to 40 GHz at 0.3 Meter

Report Number :ER-2019-10084
Operation Mode :UWB
Test Channel :4000 MHz
Test Mode :Tx CH Low
EUT Pol :E2 Plane

Test Date :2019-09-19
Temp./Humi. :23.1/59
Antenna Pol. :VERTICAL
Engineer :Nick



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Actual FS dBm	Limit @3m dBμV/m	Limit @3m dBm	Margin dB
1297.00	Peak	12.54	2.90	15.44	-79.76	19.90	-75.30	-4.46
1963.00	Peak	11.58	4.62	16.20	-79.00	31.90	-63.30	-15.70
2998.00	Peak	11.08	10.04	21.12	-74.08	33.90	-61.30	-12.78
7993.00	Peak	13.50	22.59	36.09	-59.11	53.90	-41.30	-17.81

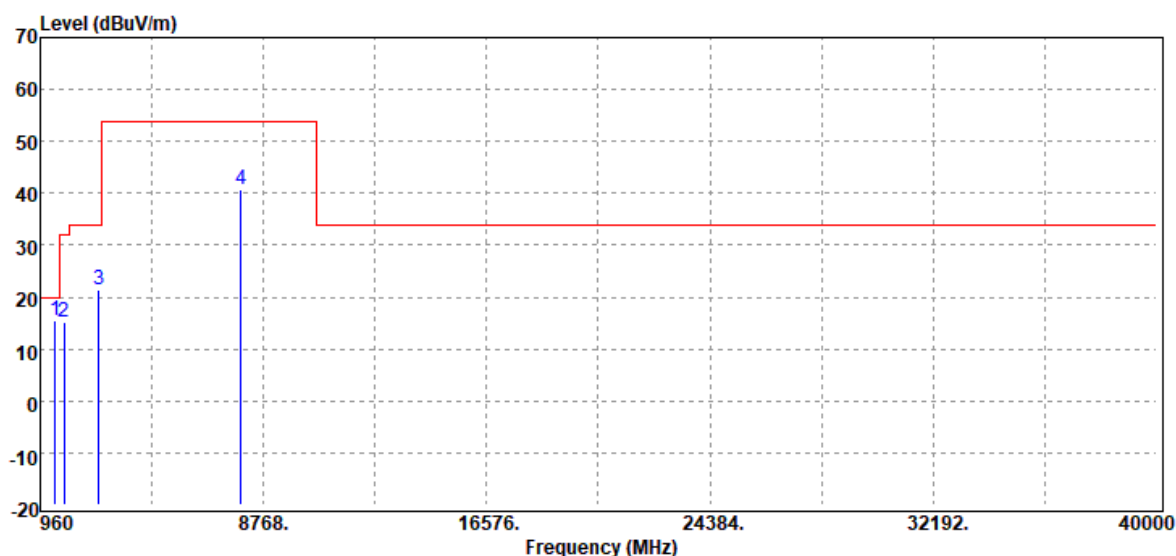
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Report Number :ER-2019-10084
 Operation Mode :UWB
 Test Channel :4000 MHz
 Test Mode :Tx CH Low
 EUT Pol :E2 Plane

Test Date :2019-09-19
 Temp./Humi. :23.1/59
 Antenna Pol. :HORIZONTAL
 Engineer :Nick



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Actual FS dBm	Limit @3m dBμV/m	Limit @3m dBm	Margin dB
1477.00	Peak	12.57	3.03	15.60	-79.60	19.90	-75.30	-4.30
1801.00	Peak	11.45	3.80	15.25	-79.95	31.90	-63.30	-16.65
2998.00	Peak	11.33	10.04	21.37	-73.83	33.90	-61.30	-12.53
7993.00	Peak	18.02	22.59	40.61	-54.59	53.90	-41.30	-13.29

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9 TRANSMITTER TIMEOUT

9.1 Standard Applicable

According to §15.519(a) (1), UWB devices operating under the provisions of this section must be hand held, i.e., they are relatively small devices that are primarily hand held while being operated and do not employ a fixed infrastructure.

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

9.2 Measurement Equipment Used

Refer to section 7.2 for details.

9.3 Test SET-UP

Refer to section 7.3 for details.

9.4 Measurement Procedure

The Transmitter Timeout was measured with a spectrum analyzer connected to the antenna port

9.5 Measurement Result

Note: Refer to next page spectrum analyzer data chart.

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Transmitter Timeout Measurement Result



Note: The receiver was removed at t = 1.96 seconds.

The last transmission occurred 2.06 seconds later which is less than the 10 seconds allowed. No additional transmissions were measured until the receiver was replaced.

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10 ANTENNA REQUIREMENT

10.1 Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

10.2 Antenna Connected Construction

The antenna utilized by the device under test is a soldered surface mount type.

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