



IMQ S.p.A. con socio unico  
Via Quintiliano, 43  
20138 MILANO - I

# TEST REPORT

## No. ARSL00035

performed in accordance with

FCC Rules: Code of Federal Regulations (CFR) no. 47  
Part 15 Subpart F Section 15.509

PRODUCT	Ground penetrating radar
MODEL(s) TESTED	STREAMX600
FCC ID	UFW-STREAMX600
TRADE MARK(s)	IDS INGEGNERIA DEI SISTEMI S.p.A

APPLICANT	IDS INGEGNERIA DEI SISTEMI S.p.A. Via E. Calabresi, 20 – I-56121 PISA
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Tested by	Robertino Torri	<i>Robertino Torri</i>
Approved by	Marco De Angelis [Area Manager]	<i>Marco De Angelis</i>

### Revision Sheet

Release No.	Date	Revision Description
Rev. 0	2011-04-01	First edition

The results of tests and checks reported in this Test Report refer exclusively to the samples tested and described in the Report itself.  
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## 1. GENERAL DATA

SAMPLE		
Samples received on	2011-03-29	(item sent and sampling by applicant)
IMQ reference samples	BEM	58649
Samples tested No.	1	
Object under analysis recognition	<b>Not carried out</b> Except where stated, characteristics of products were taken from client description and were not verified by the laboratory	
TEST LOCATION		
Testing dates	2011-03-29 ÷ 2011-03-31	
Testing laboratory.	IMQ S.p.A. - Via Quintiliano, 43 – I-20138 Milano	
Testing site	Viale Lombardia, 20 – I-20021 Bollate (MI)	
ENVIRONMENTAL CONDITIONING		
<i>Parameter</i>	<i>Measured</i>	
Ambient Temperature	25 ÷ 35 °C	
Relative Humidity	50 ÷ 60 %	
Atmospheric Pressure	900 ÷ 1000 mbar	

## 2. REFERENCE DOCUMENT

	DOCUMENT	DATE	TITLE
<input checked="" type="checkbox"/>	47 CFR Part 15	2008	Radio Frequency Device
<input checked="" type="checkbox"/>	ANSI C63.4	2009	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
<input checked="" type="checkbox"/>	ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
<input checked="" type="checkbox"/>	FCC Order, ET Docket No. 98-153 (FCC 02-48)	2002	Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems
<input checked="" type="checkbox"/>	KDB Publication No. 393764	2007	UWB Compliance Measurements

### 3. UNIT UNDER TEST (EUT) DETAILS

#### GENERAL DATA

<b>Model</b>	STREAMX600
<b>FCC ID</b>	UFW-STREAMX600

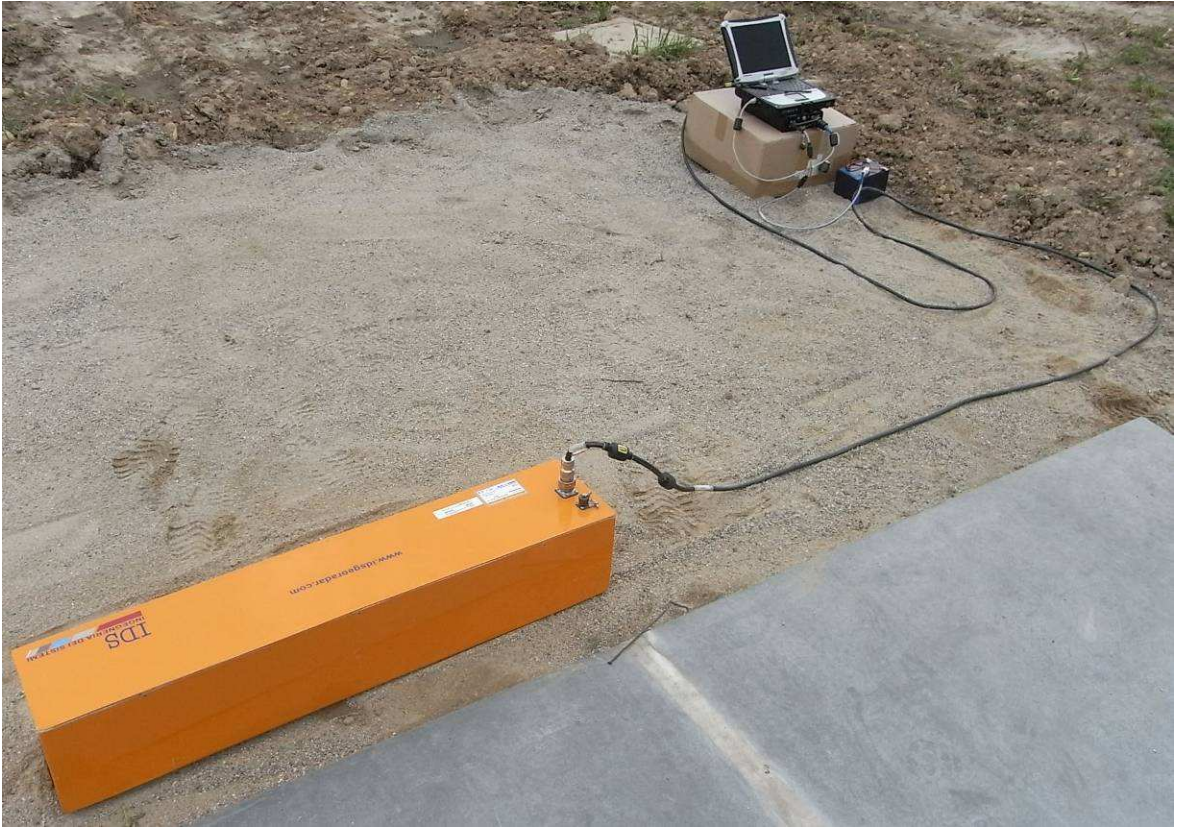
<b>Manufacturer</b>	IDS INGEGNERIA DEI SISTEMI S.p.A. Via E. Calabresi, 20 – I-56121 PISA
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<b>EUT classification</b>	Ground penetrating radar (GPR)
<b>General overview</b>	<p>The STREAMX600 system is a Ground penetrating radar (GPR) system, i.e., according to the FCC definition, a field disturbance sensor that is designed to operate only when in contact with the ground for the purpose of detecting or obtaining the images of buried objects or determining the physical properties within the ground. The energy from the GPR is intentionally directed down into the ground for this purpose.</p> <p>The STREAMX600 product includes:</p> <ul style="list-style-type: none"> <li>• one antenna including one array of six couples of transmitting and receiving dipoles in vertical polarisation;</li> <li>• the control unit (hereinafter referred as D.A.D – Digital Antenna Driver) that is linked to a laptop computer for storing the collected data.</li> </ul>
<b>Power supply type</b>	DC 12 V battery supplied
<b>Operating frequency</b>	113.834 to 414.074 MHz (10 dB Bandwidth)
<b>Channel Spacing</b>	Not applicable
<b>Pulse Repetition Frequency (PRF)</b>	200 KHz
<b>Antenna description</b>	Integral permanently attached
<b>Antenna Type</b>	Dipole

## 4. TEST CONFIGURATION OF UNIT UNDER TEST

### EUT CONFIGURATION

The Equipment under test was powered with a battery and placed directly on the dry sand with no ground plane under it.



### STATE OF THE EUT DURING TESTS

Ref.	Mode	Description
#1	Operating	Continuous transmission with the antenna fitted in a manner typical of normal indented use.

### SUPPORT EQUIPMENT

Defined as equipment needed for correct operation or loading of the EUT, but not considered as tested:

Equipment	Manufacturer	Model
None	/	/

### EUT TECHNICAL DOCUMENTATION

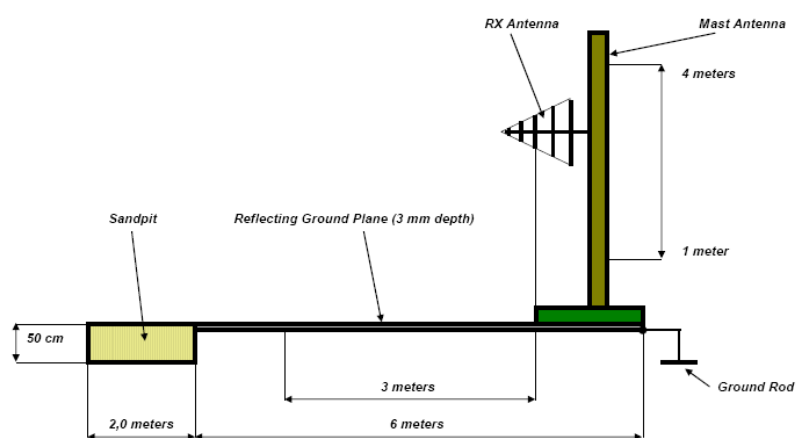
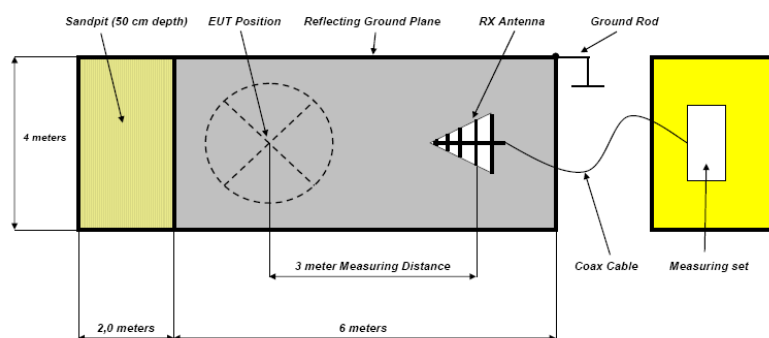
Document	Reference
DAD & antenna block diagrams	/
Safe Rail System User Guide	Protocol: MN/2011/030 rev. 1.0
Technical description of the system	STREAMX600 - Technical description of the unit

## 5. TEST SET-UP DESCRIPTION

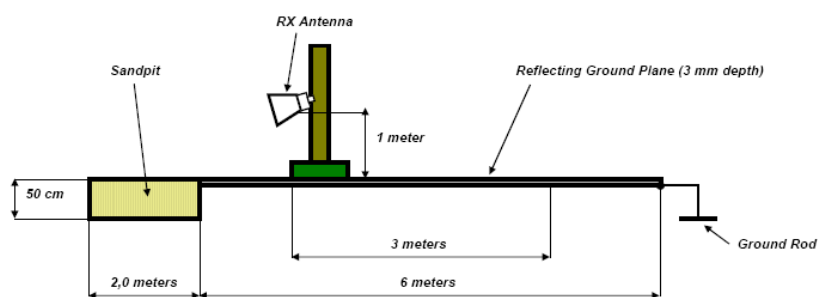
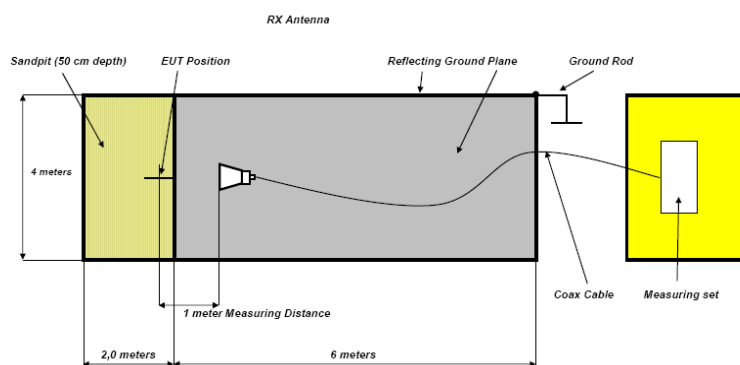
<b>Type of test facilities</b>	Open Area Test Site (OATS). The test site is flat and the level area is clear of overhead wires and reflecting structures, it is sufficiently large to permit measuring antenna placement at specified distance. Adequate spacing distance is assured between the EUT and measuring antenna to any adjacent large reflecting structures.
<b>Test distance</b>	<ul style="list-style-type: none"> <li>• 3 meters measuring distance.</li> <li>• 1 meter above 960 MHz for measurement to device not placed on the ground plane with the antenna pointed in the direction of the radiating head.</li> </ul>
<b>Ground plane</b>	Galvanized sheet steel soldered panels is installed on the floor, electric contact between the individual plates is provided via continues metallic strips. Dimensions: 6.0m x 4.0m x 3.0mm (LxWxD)
<b>Antenna positioner</b>	Semi-Automatic remotely controlled Antenna mast, scan over a range of 1 to 4 meters above the ground plane. Manual antenna polarization change.
<b>Sandpit</b>	2.0m x 4.0m x 50cm (LxWxD) sandpit area filled with dry sand placed in front of the ground plane (test on UWB Ground penetrating radar).



## Drawing



Radiated measurement below 960 MHz



Radiated measurement above 960 MHz

## 6. SUMMARY OF TEST RESULTS

POSSIBLE TEST CASE VERDICTS:	
Test object does meet the requirement	PASS
Test object does not meet the requirement	FAIL
Test case does not apply to the test object	N.A.
Test not performed	N.P.

CFR47 Part 15	TITLE	RESULT
§ 15.207(a)	Conducted Emission	N.A. <sup>1</sup>
§ 15.505	Cross reference	PASS
§ 15.507	Marketing of UWB equipment	PASS
§ 15.509	Pulse Repetition Frequency (PRF)	PASS
§ 15.509(a)	UWB Bandwidth	PASS
§ 15.509(c)	Transmission duration	PASS
§ 15.509(c) § 15.209	Radiated emission ≤ 960 MHz	PASS
§ 15.509(d)	Radiated emission > 960 MHz	PASS
§ 15.509(e)	Radiated emission in GPS bands	PASS
§ 15.509(f)	Highest radiated emission at $f_M$	PASS
§ 15.521	Technical requirements applicable to all UWB devices	PASS
§ 15.525 § 15.509(b)	Coordination requirement	PASS

<b>Note 1</b>	Port not present, battery operating device
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## 7. TEST RESULTS

### 7.1 CROSS REFERENCE

#### TEST REQUIREMENT

- a) Except where specifically stated otherwise within this subpart, the provisions of Subparts A and B and of Sections 15.201 through 15.204 and Section 15.207 of Subpart C of this part apply to unlicensed UWB intentional radiators. The provisions of Sections 15.35(c) and 15.205 do not apply to devices operated under this subpart. The provisions of Footnote US 246 to the Table of Frequency Allocations contained in Section 2.106 of this chapter does not apply to devices operated under this subpart.
- b) The requirements of Subpart F apply only to the radio transmitter, i.e., the intentional radiator, contained in the UWB device. Other aspects of the operation of a UWB device may be subject to requirements contained elsewhere in this chapter. In particular, a UWB device that contains digital circuitry not directly associated with the operation of the transmitter also is subject to the requirements for unintentional radiators in Subpart B of this chapter. Similarly, an associated receiver that operates (tunes) within the frequency range 30 MHz to 960 MHz is subject to the requirements in Subpart B of this chapter.

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

#### TEST RESULT

The EUT meets the requirements of sections 15.505.

## 7.2 MARKETING OF UWB EQUIPMENT

### TEST REQUIREMENT

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

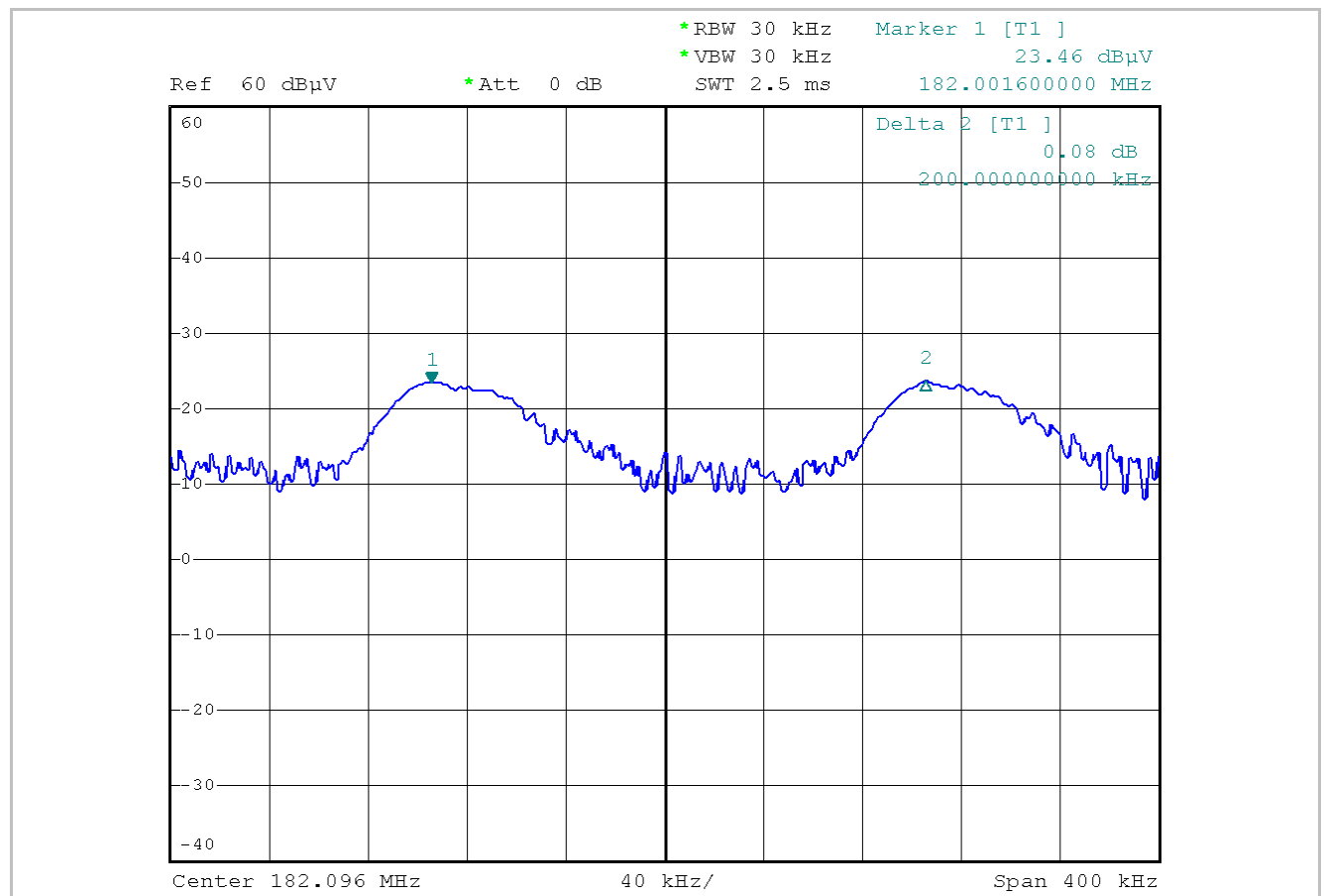
REQUIREMENT	DESCRIPTION
§ 15.507 § 2.909	The responsible party is properly informed about the responsible for ensuring that the equipment is marketed only to eligible parties, and provide correct information on the customers and users. (See Important note for the US customers of the "STREAMX600 - User manual")

### TEST RESULT

The EUT meets the requirements of sections 15.507.

### 7.3 PULSE REPETITION FREQUENCY (PRF)

TEST REQUIREMENT	
Test definition	Pulse Repetition Frequency (PRF) is the trigger repetition frequency
Test setup	ANSI C63.4
Test facility	Open Area Test Site (OATS)
Test distance	3 meters
RBW bandwidth	30 kHz
VBW bandwidth	30 kHz
Detector	A-Peak
Deviation to test procedure	None
EUT operating condition	#1
Remark	None



PRF Declared	PRF Measured	Result
200 kHz	200 kHz	PASS

## 7.4 UWB BANDWIDTH

TEST REQUIREMENT	
UWB definition	The bandwidth of a UWB emission is defined by the points on the emission spectrum where the amplitude is 10 dB below the maximum emission amplitude (i.e., the -10 dB points). In cases where the measured emission spectrum contains multiple (more than two) -10 dB points, the outermost points define the bandwidth (i.e., the widest bandwidth is assumed).
Test setup	ANSI C63.4
Test facility	Open Area Test Site (OATS)
Test distance	3 meters
RBW bandwidth	1 MHz
VBW bandwidth	3 MHz
Detector	Peak
Deviation to test procedure	None
EUT operating condition	#1
Remark	Frequency span is large enough to display a full spectrum of the RF emission

### LIMITS

The UWB bandwidth of an imaging system operating under the provisions of this section must be below 10.6 GHz.

## TEST PROCEDURE

- 1) The receiving antenna which varied from 1 to 4 m to find the highest emission is positioned 3 m away from the EUT.
- 2) Measure the Highest radiated emission at  $f_M$  as described in the test No. 8.
- 3) Recorded the upper and lower frequency that are at the side of the band bounded by the points at 10 dB below the highest radiated UWB emission level.  
Measuring the bandwidth of a UWB device using a radiated test set-up, it is imperative that appropriate adjustments be made to the measured amplitude levels to account for the frequency-dependent components of the measurement system (e.g., antenna gain or factor, pre-amplifier gain, cable loss, etc). Since UWB emissions can have bandwidths several GHz wide, these frequency-dependent characteristics can vary dramatically over the fundamental emission.  
According to the nature of the broadband emission characteristics, significant care must be taken to capture the true spectrum of emission, extremely narrow sweep widths is recommended.
- 4) The UWB bandwidth is the different of the upper and lower frequency recorded.

## SUMMARY OF TEST RESULT DATA

Frequency of Maximum emission level $f_M$	Receiver Antenna polarization	Maximum emission level @ 1 MHz RBW (Peak/QP)	Lower and Upper -10 dB frequencies		10 dB Bandwidth	Result
			Lower $f_L$	Upper $f_H$		
(MHz)	[V/H]	(dB $\mu$ V/m)	(MHz)	(MHz)	(MHz)	
208.12	V	43.88	113.834	414.074	300.24	PASS

## TEST RESULT

The EUT meets the requirements of sections 15.509(a)

## 7.5 TRANSMISSION DURATION

### TEST REQUIREMENT

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

### DESCRIPTION

The equipment is not an hand held device. When normal use is interrupted, the equipment is deactivated by a software switch.

### TEST RESULT

The EUT meets the requirements of sections 15.509(c)

## 7.6 RADIATED DISTURBANCES $\leq$ 960 MHz

TEST REQUIREMENT	
Test definition	The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in Section 15.209.
Test setup	ANSI C63.4
Test facility	Open Area Test Site (OATS)
Test distance	3 meters
RBW bandwidth	120 kHz
VBW bandwidth	1 MHz
Detector	Quasi-Peak
EUT operating condition	#1
Remark	None

LIMITS			
Frequency (MHz)	Field Strengths Limits (dB $\mu$ V/m)	Measuring RBW (kHz)	Distance (meters)
0.009-0.490	67.6-20*Logf(kHz)	1	300
0.490-1.705	87.6-20*Logf(kHz)	9	30
1.705-30	29.5	9	30
30-88	40.0	120	3
88-216	43.5	120	3
216-960	46.0	120	3



## TEST PROCEDURE

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

## SUMMARY OF TEST RESULT DATA

Frequency (MHz)	EUT Position (angle °)	Antenna Polarization (V/H)	Correcting reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
120.82	0	V	38.66	43.50	-4.84	PASS
136.34	0	H	34.95	43.50	-8.55	PASS
151.86	0	V	35.38	43.50	-8.12	PASS
182.90	0	V	36.55	43.50	-6.95	PASS
198.42	90	H	37.24	43.50	-6.26	PASS
208.12	0	V	39.82	43.50	-3.68	PASS
256.62	0	V	41.81	46.00	-4.19	PASS
286.66	0	V	41.71	46.00	-4.29	PASS
318.70	0	V	41.57	46.00	-4.43	PASS
351.68	0	V	41.79	46.00	-4.21	PASS
371.08	0	V	41.14	46.00	-4.86	PASS
406.00	0	V	39.42	46.00	-6.58	PASS
450.62	0	V	40.63	46.00	-5.37	PASS

Remark: Ambient signal were detected in the different frequency ranges, each of measured signal close or above the limits was examined with relation to the EUT.

## TEST RESULT

The EUT meets the requirements of sections 15.509(d) and 15.209.

## TEST DATA DETAILS

EUT Position (angle °)			0	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	20.64	11.00	0.41	0.00	32.05	43.50	-11.45
136.34	24.74	9.80	0.41	0.00	34.95	43.50	-8.55
151.86	19.89	8.80	0.46	0.00	29.15	43.50	-14.35
182.90	20.16	9.00	0.52	0.00	29.68	43.50	-13.82
198.42	25.35	8.60	0.52	0.00	34.47	43.50	-9.03
208.12	16.13	9.80	0.54	0.00	26.47	43.50	-17.03
256.62	19.81	12.90	0.60	0.00	33.31	46.00	-12.69
286.66	21.54	13.40	0.65	0.00	35.59	46.00	-10.41
318.70	19.29	13.90	0.67	0.00	33.86	46.00	-12.14
351.68	20.00	14.90	0.70	0.00	35.60	46.00	-10.40
371.08	20.61	15.50	0.72	0.00	36.83	46.00	-9.17
406.00	21.44	15.70	0.76	0.00	37.90	46.00	-8.10
450.62	20.88	16.50	0.81	0.00	38.19	46.00	-7.81

EUT Position (angle °)			45	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	20.34	11.00	0.41	0.00	31.75	43.50	-11.75
136.34	20.22	9.80	0.41	0.00	30.43	43.50	-13.07
151.86	20.80	8.80	0.46	0.00	30.06	43.50	-13.44
182.90	20.63	9.00	0.52	0.00	30.15	43.50	-13.35
198.42	20.93	8.60	0.52	0.00	30.05	43.50	-13.45
208.12	20.34	9.80	0.54	0.00	30.68	43.50	-12.82
256.62	20.67	12.90	0.60	0.00	34.17	46.00	-11.83
286.66	21.30	13.40	0.65	0.00	35.35	46.00	-10.65
318.70	21.29	13.90	0.67	0.00	35.86	46.00	-10.14
351.68	21.51	14.90	0.70	0.00	37.11	46.00	-8.89
371.08	21.37	15.50	0.72	0.00	37.59	46.00	-8.41
406.00	19.49	15.70	0.76	0.00	35.95	46.00	-10.05
450.62	20.74	16.50	0.81	0.00	38.05	46.00	-7.95

EUT Position (angle °)			90	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	20.49	11.00	0.41	0.00	31.90	43.50	-11.60
136.34	20.11	9.80	0.41	0.00	30.32	43.50	-13.18
151.86	20.64	8.80	0.46	0.00	29.90	43.50	-13.60
182.90	22.28	9.00	0.52	0.00	31.80	43.50	-11.70
198.42	28.12	8.60	0.52	0.00	37.24	43.50	-6.26
208.12	20.20	9.80	0.54	0.00	30.54	43.50	-12.96
256.62	23.09	12.90	0.60	0.00	36.59	46.00	-9.41
286.66	22.56	13.40	0.65	0.00	36.61	46.00	-9.39
318.70	21.86	13.90	0.67	0.00	36.43	46.00	-9.57
351.68	21.05	14.90	0.70	0.00	36.65	46.00	-9.35
371.08	20.64	15.50	0.72	0.00	36.86	46.00	-9.14
406.00	21.71	15.70	0.76	0.00	38.17	46.00	-7.83
450.62	21.33	16.50	0.81	0.00	38.64	46.00	-7.36

EUT Position (angle °)			135	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	19.99	11.00	0.41	0.00	31.40	43.50	-12.10
136.34	19.56	9.80	0.41	0.00	29.77	43.50	-13.73
151.86	21.06	8.80	0.46	0.00	30.32	43.50	-13.18
182.90	20.36	9.00	0.52	0.00	29.88	43.50	-13.62
198.42	27.36	8.60	0.52	0.00	36.48	43.50	-7.02
208.12	19.94	9.80	0.54	0.00	30.28	43.50	-13.22
256.62	21.92	12.90	0.60	0.00	35.42	46.00	-10.58
286.66	20.72	13.40	0.65	0.00	34.77	46.00	-11.23
318.70	20.45	13.90	0.67	0.00	35.02	46.00	-10.98
351.68	20.08	14.90	0.70	0.00	35.68	46.00	-10.32
371.08	19.33	15.50	0.72	0.00	35.55	46.00	-10.45
406.00	19.75	15.70	0.76	0.00	36.21	46.00	-9.79
450.62	21.47	16.50	0.81	0.00	38.78	46.00	-7.22

EUT Position (angle °)			180	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	19.81	11.00	0.41	0.00	31.22	43.50	-12.28
136.34	18.85	9.80	0.41	0.00	29.06	43.50	-14.44
151.86	20.04	8.80	0.46	0.00	29.30	43.50	-14.20
182.90	19.22	9.00	0.52	0.00	28.74	43.50	-14.76
198.42	27.01	8.60	0.52	0.00	36.13	43.50	-7.37
208.12	19.34	9.80	0.54	0.00	29.68	43.50	-13.82
256.62	18.53	12.90	0.60	0.00	32.03	46.00	-13.97
286.66	20.55	13.40	0.65	0.00	34.60	46.00	-11.40
318.70	18.76	13.90	0.67	0.00	33.33	46.00	-12.67
351.68	19.23	14.90	0.70	0.00	34.83	46.00	-11.17
371.08	20.60	15.50	0.72	0.00	36.82	46.00	-9.18
406.00	19.97	15.70	0.76	0.00	36.43	46.00	-9.57
450.62	19.82	16.50	0.81	0.00	37.13	46.00	-8.87

EUT Position (angle °)			225	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	19.29	11.00	0.41	0.00	30.70	43.50	-12.80
136.34	21.07	9.80	0.41	0.00	31.28	43.50	-12.22
151.86	19.25	8.80	0.46	0.00	28.51	43.50	-14.99
182.90	19.95	9.00	0.52	0.00	29.47	43.50	-14.03
198.42	25.89	8.60	0.52	0.00	35.01	43.50	-8.49
208.12	19.63	9.80	0.54	0.00	29.97	43.50	-13.53
256.62	19.31	12.90	0.60	0.00	32.81	46.00	-13.19
286.66	20.42	13.40	0.65	0.00	34.47	46.00	-11.53
318.70	21.65	13.90	0.67	0.00	36.22	46.00	-9.78
351.68	20.53	14.90	0.70	0.00	36.13	46.00	-9.87
371.08	18.96	15.50	0.72	0.00	35.18	46.00	-10.82
406.00	20.76	15.70	0.76	0.00	37.22	46.00	-8.78
450.62	19.77	16.50	0.81	0.00	37.08	46.00	-8.92

EUT Position (angle °)			270	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	20.31	11.00	0.41	0.00	31.72	43.50	-11.78
136.34	20.78	9.80	0.41	0.00	30.99	43.50	-12.51
151.86	19.93	8.80	0.46	0.00	29.19	43.50	-14.31
182.90	20.27	9.00	0.52	0.00	29.79	43.50	-13.71
198.42	24.82	8.60	0.52	0.00	33.94	43.50	-9.56
208.12	20.02	9.80	0.54	0.00	30.36	43.50	-13.14
256.62	20.80	12.90	0.60	0.00	34.30	46.00	-11.70
286.66	22.61	13.40	0.65	0.00	36.66	46.00	-9.34
318.70	22.33	13.90	0.67	0.00	36.90	46.00	-9.10
351.68	21.00	14.90	0.70	0.00	36.60	46.00	-9.40
371.08	19.55	15.50	0.72	0.00	35.77	46.00	-10.23
406.00	20.03	15.70	0.76	0.00	36.49	46.00	-9.51
450.62	20.59	16.50	0.81	0.00	37.90	46.00	-8.10

EUT Position (angle °)			315	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	19.73	11.00	0.41	0.00	31.14	43.50	-12.36
136.34	20.41	9.80	0.41	0.00	30.62	43.50	-12.88
151.86	19.96	8.80	0.46	0.00	29.22	43.50	-14.28
182.90	20.07	9.00	0.52	0.00	29.59	43.50	-13.91
198.42	21.72	8.60	0.52	0.00	30.84	43.50	-12.66
208.12	21.32	9.80	0.54	0.00	31.66	43.50	-11.84
256.62	19.70	12.90	0.60	0.00	33.20	46.00	-12.80
286.66	19.39	13.40	0.65	0.00	33.44	46.00	-12.56
318.70	19.35	13.90	0.67	0.00	33.92	46.00	-12.08
351.68	19.72	14.90	0.70	0.00	35.32	46.00	-10.68
371.08	19.17	15.50	0.72	0.00	35.39	46.00	-10.61
406.00	19.93	15.70	0.76	0.00	36.39	46.00	-9.61
450.62	20.71	16.50	0.81	0.00	38.02	46.00	-7.98

EUT Position (angle °)			0	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	27.25	11.00	0.41	0.00	38.66	43.50	-4.84
136.34	23.88	9.80	0.41	0.00	34.09	43.50	-9.41
151.86	26.12	8.80	0.46	0.00	35.38	43.50	-8.12
182.90	27.03	9.00	0.52	0.00	36.55	43.50	-6.95
198.42	27.67	8.60	0.52	0.00	36.79	43.50	-6.71
208.12	29.48	9.80	0.54	0.00	39.82	43.50	-3.68
256.62	28.31	12.90	0.60	0.00	41.81	46.00	-4.19
286.66	27.66	13.40	0.65	0.00	41.71	46.00	-4.29
318.70	27.00	13.90	0.67	0.00	41.57	46.00	-4.43
351.68	26.19	14.90	0.70	0.00	41.79	46.00	-4.21
371.08	24.92	15.50	0.72	0.00	41.14	46.00	-4.86
406.00	22.96	15.70	0.76	0.00	39.42	46.00	-6.58
450.62	23.32	16.50	0.81	0.00	40.63	46.00	-5.37

EUT Position (angle °)			45	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	23.46	11.00	0.41	0.00	34.87	43.50	-8.63
136.34	23.10	9.80	0.41	0.00	33.31	43.50	-10.19
151.86	23.46	8.80	0.46	0.00	32.72	43.50	-10.78
182.90	22.15	9.00	0.52	0.00	31.67	43.50	-11.83
198.42	22.74	8.60	0.52	0.00	31.86	43.50	-11.64
208.12	24.37	9.80	0.54	0.00	34.71	43.50	-8.79
256.62	21.42	12.90	0.60	0.00	34.92	46.00	-11.08
286.66	22.03	13.40	0.65	0.00	36.08	46.00	-9.92
318.70	20.99	13.90	0.67	0.00	35.56	46.00	-10.44
351.68	21.44	14.90	0.70	0.00	37.04	46.00	-8.96
371.08	20.78	15.50	0.72	0.00	37.00	46.00	-9.00
406.00	20.53	15.70	0.76	0.00	36.99	46.00	-9.01
450.62	19.23	16.50	0.81	0.00	36.54	46.00	-9.46

EUT Position (angle °)			90	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	23.10	11.00	0.41	0.00	34.51	43.50	-8.99
136.34	23.54	9.80	0.41	0.00	33.75	43.50	-9.75
151.86	23.19	8.80	0.46	0.00	32.45	43.50	-11.05
182.90	22.20	9.00	0.52	0.00	31.72	43.50	-11.78
198.42	23.56	8.60	0.52	0.00	32.68	43.50	-10.82
208.12	25.95	9.80	0.54	0.00	36.29	43.50	-7.21
256.62	21.00	12.90	0.60	0.00	34.50	46.00	-11.50
286.66	20.65	13.40	0.65	0.00	34.70	46.00	-11.30
318.70	19.63	13.90	0.67	0.00	34.20	46.00	-11.80
351.68	20.62	14.90	0.70	0.00	36.22	46.00	-9.78
371.08	19.88	15.50	0.72	0.00	36.10	46.00	-9.90
406.00	19.20	15.70	0.76	0.00	35.66	46.00	-10.34
450.62	20.58	16.50	0.81	0.00	37.89	46.00	-8.11

EUT Position (angle °)			135	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	23.82	11.00	0.41	0.00	35.23	43.50	-8.27
136.34	22.38	9.80	0.41	0.00	32.59	43.50	-10.91
151.86	23.79	8.80	0.46	0.00	33.05	43.50	-10.45
182.90	23.38	9.00	0.52	0.00	32.90	43.50	-10.60
198.42	23.45	8.60	0.52	0.00	32.57	43.50	-10.93
208.12	23.49	9.80	0.54	0.00	33.83	43.50	-9.67
256.62	22.53	12.90	0.60	0.00	36.03	46.00	-9.97
286.66	22.94	13.40	0.65	0.00	36.99	46.00	-9.01
318.70	21.74	13.90	0.67	0.00	36.31	46.00	-9.69
351.68	21.43	14.90	0.70	0.00	37.03	46.00	-8.97
371.08	20.08	15.50	0.72	0.00	36.30	46.00	-9.70
406.00	20.32	15.70	0.76	0.00	36.78	46.00	-9.22
450.62	20.17	16.50	0.81	0.00	37.48	46.00	-8.52

EUT Position (angle °)			180	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	24.53	11.00	0.41	0.00	35.94	43.50	-7.56
136.34	23.82	9.80	0.41	0.00	34.03	43.50	-9.47
151.86	24.07	8.80	0.46	0.00	33.33	43.50	-10.17
182.90	25.37	9.00	0.52	0.00	34.89	43.50	-8.61
198.42	25.35	8.60	0.52	0.00	34.47	43.50	-9.03
208.12	24.85	9.80	0.54	0.00	35.19	43.50	-8.31
256.62	23.81	12.90	0.60	0.00	37.31	46.00	-8.69
286.66	23.76	13.40	0.65	0.00	37.81	46.00	-8.19
318.70	22.07	13.90	0.67	0.00	36.64	46.00	-9.36
351.68	21.39	14.90	0.70	0.00	36.99	46.00	-9.01
371.08	21.21	15.50	0.72	0.00	37.43	46.00	-8.57
406.00	19.78	15.70	0.76	0.00	36.24	46.00	-9.76
450.62	21.46	16.50	0.81	0.00	38.77	46.00	-7.23

EUT Position (angle °)			225	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	23.70	11.00	0.41	0.00	35.11	43.50	-8.39
136.34	22.14	9.80	0.41	0.00	32.35	43.50	-11.15
151.86	24.31	8.80	0.46	0.00	33.57	43.50	-9.93
182.90	23.30	9.00	0.52	0.00	32.82	43.50	-10.68
198.42	23.40	8.60	0.52	0.00	32.52	43.50	-10.98
208.12	25.39	9.80	0.54	0.00	35.73	43.50	-7.77
256.62	23.34	12.90	0.60	0.00	36.84	46.00	-9.16
286.66	21.04	13.40	0.65	0.00	35.09	46.00	-10.91
318.70	19.70	13.90	0.67	0.00	34.27	46.00	-11.73
351.68	20.75	14.90	0.70	0.00	36.35	46.00	-9.65
371.08	19.30	15.50	0.72	0.00	35.52	46.00	-10.48
406.00	20.54	15.70	0.76	0.00	37.00	46.00	-9.00
450.62	20.25	16.50	0.81	0.00	37.56	46.00	-8.44

EUT Position (angle °)			270	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	21.48	11.00	0.41	0.00	32.89	43.50	-10.61
136.34	23.34	9.80	0.41	0.00	33.55	43.50	-9.95
151.86	20.55	8.80	0.46	0.00	29.81	43.50	-13.69
182.90	21.79	9.00	0.52	0.00	31.31	43.50	-12.19
198.42	23.02	8.60	0.52	0.00	32.14	43.50	-11.36
208.12	22.76	9.80	0.54	0.00	33.10	43.50	-10.40
256.62	20.27	12.90	0.60	0.00	33.77	46.00	-12.23
286.66	21.31	13.40	0.65	0.00	35.36	46.00	-10.64
318.70	19.90	13.90	0.67	0.00	34.47	46.00	-11.53
351.68	20.79	14.90	0.70	0.00	36.39	46.00	-9.61
371.08	20.51	15.50	0.72	0.00	36.73	46.00	-9.27
406.00	20.71	15.70	0.76	0.00	37.17	46.00	-8.83
450.62	20.09	16.50	0.81	0.00	37.40	46.00	-8.60

EUT Position (angle °)			315	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
120.82	24.47	11.00	0.41	0.00	35.88	43.50	-7.62
136.34	23.82	9.80	0.41	0.00	34.03	43.50	-9.47
151.86	23.23	8.80	0.46	0.00	32.49	43.50	-11.01
182.90	24.86	9.00	0.52	0.00	34.38	43.50	-9.12
198.42	25.91	8.60	0.52	0.00	35.03	43.50	-8.47
208.12	26.27	9.80	0.54	0.00	36.61	43.50	-6.89
256.62	25.24	12.90	0.60	0.00	38.74	46.00	-7.26
286.66	24.15	13.40	0.65	0.00	38.20	46.00	-7.80
318.70	23.17	13.90	0.67	0.00	37.74	46.00	-8.26
351.68	21.29	14.90	0.70	0.00	36.89	46.00	-9.11
371.08	20.37	15.50	0.72	0.00	36.59	46.00	-9.41
406.00	21.78	15.70	0.76	0.00	38.24	46.00	-7.76
450.62	20.29	16.50	0.81	0.00	37.60	46.00	-8.40



## 7.6 RADIATED DISTURBANCES > 960 MHz

TEST REQUIREMENT	
Test definition	The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz.
Test setup	ANSI C63.4
Test facility	Open Area Test Site (OATS)
Test distance	1 meter
RBW bandwidth	1 MHz
VBW bandwidth	1 MHz
Detector	RMS
EUT operating condition	#1
Remark	None

LIMITS			
Frequency (MHz)	EIRP @ 3 meters (1 MHz BW) (dBm)	Field strength @ 3 meters (1 MHz BW) (dBμV/m)	Field strength @ 1 meters (1 MHz BW) (dBμV/m)
960-1610	-65.3	29.9	39.4
1610-1990	-53.3	41.9	51.4
1990-3100	-51.3	43.9	53.4
3100-10600	-41.3	53.9	63.4
Above 10600	-51.3	43.9	53.4

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

## TEST PROCEDURE

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

## SUMMARY OF TEST RESULT DATA

All maximum Field strength emission are found at the following test set-up conditions

Frequency (MHz)	EUT Position (angle °)	Antenna Polarization (V/H)	Correcting reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
1010	270	V	37.39	39.40	-2.01	PASS
1044	0	H	38.25	39.40	-1.15	PASS
1152	180	H	37.90	39.40	-1.50	PASS
1193	0	V	36.20	39.40	-3.20	PASS
1355	315	V	36.61	39.40	-2.79	PASS
1603	180	H	35.88	39.40	-3.52	PASS
1969	270	H	35.15	51.40	-16.25	PASS
2276	270	H	34.76	53.40	-18.64	PASS
2684	0	H	37.61	53.40	-15.79	PASS
3408	180	H	37.70	63.40	-25.70	PASS
3772	90	H	38.35	63.40	-25.05	PASS
4080	90	H	38.87	63.40	-24.53	PASS
5196	180	H	41.08	63.40	-22.32	PASS

## TEST RESULT

The EUT meets the requirements of sections 15.509(d)

## TEST DATA DETAILS

EUT Position (angle °)			0	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1010	47.97	24.50	1.24	38.82	34.89	39.40	-4.51
1044	51.33	24.50	1.24	38.82	38.25	39.40	-1.15
1152	44.72	24.60	1.30	38.82	31.80	39.40	-7.60
1193	45.02	24.70	1.42	38.82	32.32	39.40	-7.08
1355	46.21	24.70	1.52	38.83	33.60	39.40	-5.80
1603	47.43	25.50	1.68	38.85	35.76	39.40	-3.64
1969	43.73	26.00	1.89	37.47	34.15	51.40	-17.25
2276	43.19	26.50	2.08	37.50	34.27	53.40	-19.13
2684	45.03	27.80	2.28	37.50	37.61	53.40	-15.79
3408	43.39	28.80	2.37	37.30	37.26	63.40	-26.14
3772	43.61	29.20	2.60	37.10	38.31	63.40	-25.09
4080	43.02	29.80	2.63	37.00	38.45	63.40	-24.95
5196	42.06	31.90	3.60	36.80	40.76	63.40	-22.64

EUT Position (angle °)			45	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1010	47.61	24.50	1.24	38.82	34.53	39.40	-4.87
1044	48.86	24.50	1.24	38.82	35.78	39.40	-3.62
1152	47.96	24.60	1.30	38.82	35.04	39.40	-4.36
1193	46.01	24.70	1.42	38.82	33.31	39.40	-6.09
1355	44.95	24.70	1.52	38.83	32.34	39.40	-7.06
1603	47.55	25.50	1.68	38.85	35.88	39.40	-3.52
1969	43.48	26.00	1.89	37.47	33.90	51.40	-17.50
2276	43.15	26.50	2.08	37.50	34.23	53.40	-19.17
2684	44.56	27.80	2.28	37.50	37.14	53.40	-16.26
3408	43.52	28.80	2.37	37.30	37.39	63.40	-26.01
3772	43.60	29.20	2.60	37.10	38.30	63.40	-25.10
4080	43.27	29.80	2.63	37.00	38.70	63.40	-24.70
5196	42.16	31.90	3.60	36.80	40.86	63.40	-22.54

EUT Position (angle °)			90	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1010	48.38	24.50	1.24	38.82	35.30	39.40	-4.10
1044	50.72	24.50	1.24	38.82	37.64	39.40	-1.76
1152	50.63	24.60	1.30	38.82	37.71	39.40	-1.69
1193	46.78	24.70	1.42	38.82	34.08	39.40	-5.32
1355	45.53	24.70	1.52	38.83	32.92	39.40	-6.48
1603	46.53	25.50	1.68	38.85	34.86	39.40	-4.54
1969	44.04	26.00	1.89	37.47	34.46	51.40	-16.94
2276	43.54	26.50	2.08	37.50	34.62	53.40	-18.78
2684	43.52	27.80	2.28	37.50	36.10	53.40	-17.30
3408	43.29	28.80	2.37	37.30	37.16	63.40	-26.24
3772	43.65	29.20	2.60	37.10	38.35	63.40	-25.05
4080	43.44	29.80	2.63	37.00	38.87	63.40	-24.53
5196	42.23	31.90	3.60	36.80	40.93	63.40	-22.47

EUT Position (angle °)			135	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBµV)	(dB1/m)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
1010	49.10	24.50	1.24	38.82	36.02	39.40	-3.38
1044	48.62	24.50	1.24	38.82	35.54	39.40	-3.86
1152	50.06	24.60	1.30	38.82	37.14	39.40	-2.26
1193	46.01	24.70	1.42	38.82	33.31	39.40	-6.09
1355	45.92	24.70	1.52	38.83	33.31	39.40	-6.09
1603	47.36	25.50	1.68	38.85	35.69	39.40	-3.71
1969	44.13	26.00	1.89	37.47	34.55	51.40	-16.85
2276	43.03	26.50	2.08	37.50	34.11	53.40	-19.29
2684	44.58	27.80	2.28	37.50	37.16	53.40	-16.24
3408	43.27	28.80	2.37	37.30	37.14	63.40	-26.26
3772	43.63	29.20	2.60	37.10	38.33	63.40	-25.07
4080	42.85	29.80	2.63	37.00	38.28	63.40	-25.12
5196	42.20	31.90	3.60	36.80	40.90	63.40	-22.50

EUT Position (angle °)			180	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBµV)	(dB1/m)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
1010	47.64	24.50	1.24	38.82	34.56	39.40	-4.84
1044	48.31	24.50	1.24	38.82	35.23	39.40	-4.17
1152	50.82	24.60	1.30	38.82	37.90	39.40	-1.50
1193	44.91	24.70	1.42	38.82	32.21	39.40	-7.19
1355	46.41	24.70	1.52	38.83	33.80	39.40	-5.60
1603	47.55	25.50	1.68	38.85	35.88	39.40	-3.52
1969	43.50	26.00	1.89	37.47	33.92	51.40	-17.48
2276	43.63	26.50	2.08	37.50	34.71	53.40	-18.69
2684	44.10	27.80	2.28	37.50	36.68	53.40	-16.72
3408	43.83	28.80	2.37	37.30	37.70	63.40	-25.70
3772	43.49	29.20	2.60	37.10	38.19	63.40	-25.21
4080	43.35	29.80	2.63	37.00	38.78	63.40	-24.62
5196	42.38	31.90	3.60	36.80	41.08	63.40	-22.32

EUT Position (angle °)			225	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBµV)	(dB1/m)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
1010	49.49	24.50	1.24	38.82	36.41	39.40	-2.99
1044	50.90	24.50	1.24	38.82	37.82	39.40	-1.58
1152	46.40	24.60	1.30	38.82	33.48	39.40	-5.92
1193	46.82	24.70	1.42	38.82	34.12	39.40	-5.28
1355	46.33	24.70	1.52	38.83	33.72	39.40	-5.68
1603	46.94	25.50	1.68	38.85	35.27	39.40	-4.13
1969	44.03	26.00	1.89	37.47	34.45	51.40	-16.95
2276	43.34	26.50	2.08	37.50	34.42	53.40	-18.98
2684	44.54	27.80	2.28	37.50	37.12	53.40	-16.28
3408	43.54	28.80	2.37	37.30	37.41	63.40	-25.99
3772	43.55	29.20	2.60	37.10	38.25	63.40	-25.15
4080	43.03	29.80	2.63	37.00	38.46	63.40	-24.94
5196	42.10	31.90	3.60	36.80	40.80	63.40	-22.60

EUT Position (angle °)			270	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1010	47.96	24.50	1.24	38.82	34.88	39.40	-4.52
1044	50.53	24.50	1.24	38.82	37.45	39.40	-1.95
1152	46.53	24.60	1.30	38.82	33.61	39.40	-5.79
1193	47.06	24.70	1.42	38.82	34.36	39.40	-5.04
1355	45.32	24.70	1.52	38.83	32.71	39.40	-6.69
1603	47.50	25.50	1.68	38.85	35.83	39.40	-3.57
1969	44.73	26.00	1.89	37.47	35.15	51.40	-16.25
2276	43.68	26.50	2.08	37.50	34.76	53.40	-18.64
2684	44.69	27.80	2.28	37.50	37.27	53.40	-16.13
3408	43.53	28.80	2.37	37.30	37.40	63.40	-26.00
3772	43.58	29.20	2.60	37.10	38.28	63.40	-25.12
4080	43.11	29.80	2.63	37.00	38.54	63.40	-24.86
5196	42.00	31.90	3.60	36.80	40.70	63.40	-22.70

EUT Position (angle °)			315	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1010	49.93	24.50	1.24	38.82	36.85	39.40	-2.55
1044	48.34	24.50	1.24	38.82	35.26	39.40	-4.14
1152	45.07	24.60	1.30	38.82	32.15	39.40	-7.25
1193	45.21	24.70	1.42	38.82	32.51	39.40	-6.89
1355	44.67	24.70	1.52	38.83	32.06	39.40	-7.34
1603	46.73	25.50	1.68	38.85	35.06	39.40	-4.34
1969	42.75	26.00	1.89	37.47	33.17	51.40	-18.23
2276	43.10	26.50	2.08	37.50	34.18	53.40	-19.22
2684	44.26	27.80	2.28	37.50	36.84	53.40	-16.56
3408	43.29	28.80	2.37	37.30	37.16	63.40	-26.24
3772	43.48	29.20	2.60	37.10	38.18	63.40	-25.22
4080	43.13	29.80	2.63	37.00	38.56	63.40	-24.84
5196	42.18	31.90	3.60	36.80	40.88	63.40	-22.52

EUT Position (angle °)			0	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1010	48.89	24.50	1.24	38.82	35.81	39.40	-3.59
1044	50.49	24.50	1.24	38.82	37.41	39.40	-1.99
1152	45.15	24.60	1.30	38.82	32.23	39.40	-7.17
1193	48.90	24.70	1.42	38.82	36.20	39.40	-3.20
1355	46.94	24.70	1.52	38.83	34.33	39.40	-5.07
1603	45.54	25.50	1.68	38.85	33.87	39.40	-5.53
1969	42.78	26.00	1.89	37.47	33.20	51.40	-18.20
2276	42.73	26.50	2.08	37.50	33.81	53.40	-19.59
2684	42.18	27.80	2.28	37.50	34.76	53.40	-18.64
3408	37.60	28.80	2.37	37.30	31.47	63.40	-31.93
3772	37.61	29.20	2.60	37.10	32.31	63.40	-31.09
4080	37.65	29.80	2.63	37.00	33.08	63.40	-30.32
5196	36.97	31.90	3.60	36.80	35.67	63.40	-27.73

EUT Position (angle °)			45	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1010	48.60	24.50	1.24	38.82	35.52	39.40	-3.88
1044	48.38	24.50	1.24	38.82	35.30	39.40	-4.10
1152	44.89	24.60	1.30	38.82	31.97	39.40	-7.43
1193	45.64	24.70	1.42	38.82	32.94	39.40	-6.46
1355	45.45	24.70	1.52	38.83	32.84	39.40	-6.56
1603	44.28	25.50	1.68	38.85	32.61	39.40	-6.79
1969	41.51	26.00	1.89	37.47	31.93	51.40	-19.47
2276	41.67	26.50	2.08	37.50	32.75	53.40	-20.65
2684	41.77	27.80	2.28	37.50	34.35	53.40	-19.05
3408	37.95	28.80	2.37	37.30	31.82	63.40	-31.58
3772	37.98	29.20	2.60	37.10	32.68	63.40	-30.72
4080	37.15	29.80	2.63	37.00	32.58	63.40	-30.82
5196	36.39	31.90	3.60	36.80	35.09	63.40	-28.31

EUT Position (angle °)			90	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1010	49.15	24.50	1.24	38.82	36.07	39.40	-3.33
1044	49.52	24.50	1.24	38.82	36.44	39.40	-2.96
1152	46.77	24.60	1.30	38.82	33.85	39.40	-5.55
1193	46.13	24.70	1.42	38.82	33.43	39.40	-5.97
1355	44.02	24.70	1.52	38.83	31.41	39.40	-7.99
1603	42.86	25.50	1.68	38.85	31.19	39.40	-8.21
1969	41.99	26.00	1.89	37.47	32.41	51.40	-18.99
2276	41.13	26.50	2.08	37.50	32.21	53.40	-21.19
2684	41.67	27.80	2.28	37.50	34.25	53.40	-19.15
3408	37.89	28.80	2.37	37.30	31.76	63.40	-31.64
3772	37.62	29.20	2.60	37.10	32.32	63.40	-31.08
4080	37.36	29.80	2.63	37.00	32.79	63.40	-30.61
5196	36.48	31.90	3.60	36.80	35.18	63.40	-28.22

EUT Position (angle °)			135	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1010	45.48	24.50	1.24	38.82	32.40	39.40	-7.00
1044	51.17	24.50	1.24	38.82	38.09	39.40	-1.31
1152	44.20	24.60	1.30	38.82	31.28	39.40	-8.12
1193	48.06	24.70	1.42	38.82	35.36	39.40	-4.04
1355	46.00	24.70	1.52	38.83	33.39	39.40	-6.01
1603	42.71	25.50	1.68	38.85	31.04	39.40	-8.36
1969	40.98	26.00	1.89	37.47	31.40	51.40	-20.00
2276	42.14	26.50	2.08	37.50	33.22	53.40	-20.18
2684	42.57	27.80	2.28	37.50	35.15	53.40	-18.25
3408	37.51	28.80	2.37	37.30	31.38	63.40	-32.02
3772	37.94	29.20	2.60	37.10	32.64	63.40	-30.76
4080	37.18	29.80	2.63	37.00	32.61	63.40	-30.79
5196	36.67	31.90	3.60	36.80	35.37	63.40	-28.03

EUT Position (angle °)			180	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1010	50.24	24.50	1.24	38.82	37.16	39.40	-2.24
1044	50.79	24.50	1.24	38.82	37.71	39.40	-1.69
1152	42.57	24.60	1.30	38.82	29.65	39.40	-9.75
1193	46.32	24.70	1.42	38.82	33.62	39.40	-5.78
1355	47.98	24.70	1.52	38.83	35.37	39.40	-4.03
1603	46.97	25.50	1.68	38.85	35.30	39.40	-4.10
1969	42.38	26.00	1.89	37.47	32.80	51.40	-18.60
2276	41.85	26.50	2.08	37.50	32.93	53.40	-20.47
2684	42.03	27.80	2.28	37.50	34.61	53.40	-18.79
3408	38.11	28.80	2.37	37.30	31.98	63.40	-31.42
3772	37.85	29.20	2.60	37.10	32.55	63.40	-30.85
4080	37.49	29.80	2.63	37.00	32.92	63.40	-30.48
5196	36.71	31.90	3.60	36.80	35.41	63.40	-27.99

EUT Position (angle °)			225	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1010	48.94	24.50	1.24	38.82	35.86	39.40	-3.54
1044	49.21	24.50	1.24	38.82	36.13	39.40	-3.27
1152	50.59	24.60	1.30	38.82	37.67	39.40	-1.73
1193	47.91	24.70	1.42	38.82	35.21	39.40	-4.19
1355	47.66	24.70	1.52	38.83	35.05	39.40	-4.35
1603	45.09	25.50	1.68	38.85	33.42	39.40	-5.98
1969	41.07	26.00	1.89	37.47	31.49	51.40	-19.91
2276	41.65	26.50	2.08	37.50	32.73	53.40	-20.67
2684	41.46	27.80	2.28	37.50	34.04	53.40	-19.36
3408	37.49	28.80	2.37	37.30	31.36	63.40	-32.04
3772	37.84	29.20	2.60	37.10	32.54	63.40	-30.86
4080	37.26	29.80	2.63	37.00	32.69	63.40	-30.71
5196	36.56	31.90	3.60	36.80	35.26	63.40	-28.14



EUT Position (angle °)			270	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1010	50.47	24.50	1.24	38.82	37.39	39.40	-2.01
1044	50.64	24.50	1.24	38.82	37.56	39.40	-1.84
1152	46.91	24.60	1.30	38.82	33.99	39.40	-5.41
1193	48.29	24.70	1.42	38.82	35.59	39.40	-3.81
1355	46.40	24.70	1.52	38.83	33.79	39.40	-5.61
1603	43.04	25.50	1.68	38.85	31.37	39.40	-8.03
1969	41.82	26.00	1.89	37.47	32.24	51.40	-19.16
2276	41.68	26.50	2.08	37.50	32.76	53.40	-20.64
2684	41.00	27.80	2.28	37.50	33.58	53.40	-19.82
3408	37.61	28.80	2.37	37.30	31.48	63.40	-31.92
3772	37.97	29.20	2.60	37.10	32.67	63.40	-30.73
4080	37.29	29.80	2.63	37.00	32.72	63.40	-30.68
5196	36.58	31.90	3.60	36.80	35.28	63.40	-28.12

EUT Position (angle °)			315	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1010	48.59	24.50	1.24	38.82	35.51	39.40	-3.89
1044	48.01	24.50	1.24	38.82	34.93	39.40	-4.47
1152	44.02	24.60	1.30	38.82	31.10	39.40	-8.30
1193	47.84	24.70	1.42	38.82	35.14	39.40	-4.26
1355	49.22	24.70	1.52	38.83	36.61	39.40	-2.79
1603	45.38	25.50	1.68	38.85	33.71	39.40	-5.69
1969	43.40	26.00	1.89	37.47	33.82	51.40	-17.58
2276	41.73	26.50	2.08	37.50	32.81	53.40	-20.59
2684	42.33	27.80	2.28	37.50	34.91	53.40	-18.49
3408	37.50	28.80	2.37	37.30	31.37	63.40	-32.03
3772	37.89	29.20	2.60	37.10	32.59	63.40	-30.81
4080	37.29	29.80	2.63	37.00	32.72	63.40	-30.68
5196	36.64	31.90	3.60	36.80	35.34	63.40	-28.06

## 7.8 RADIATED EMISSION IN GPS BANDS

TEST REQUIREMENT	
Test definition	In addition to the radiated emission limits specified for frequency above 960 MHz, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz in the GPS frequency bands.
Test setup	ANSI C63.4
Test facility	Open Area Test Site (OATS)
Test distance	1 meter
RBW bandwidth	1 kHz
VBW bandwidth	3 MHz
Detector	RMS
EUT operating condition	#1
Remark	None

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

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

## TEST PROCEDURE

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

## SUMMARY OF TEST RESULT DATA

All maximum Field strength emission are found at the following test set-up conditions

### GPS band 1

EUT Position (angle °)			315	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1180.72	19.80	24.70	1.42	38.82	7.10	29.40	-22.30
1190.45	17.91	24.70	1.42	38.82	5.21	29.40	-24.19
1193.64	18.91	24.70	1.42	38.82	6.21	29.40	-23.19
1195.16	18.39	24.70	1.42	38.82	6.21	29.40	-23.19

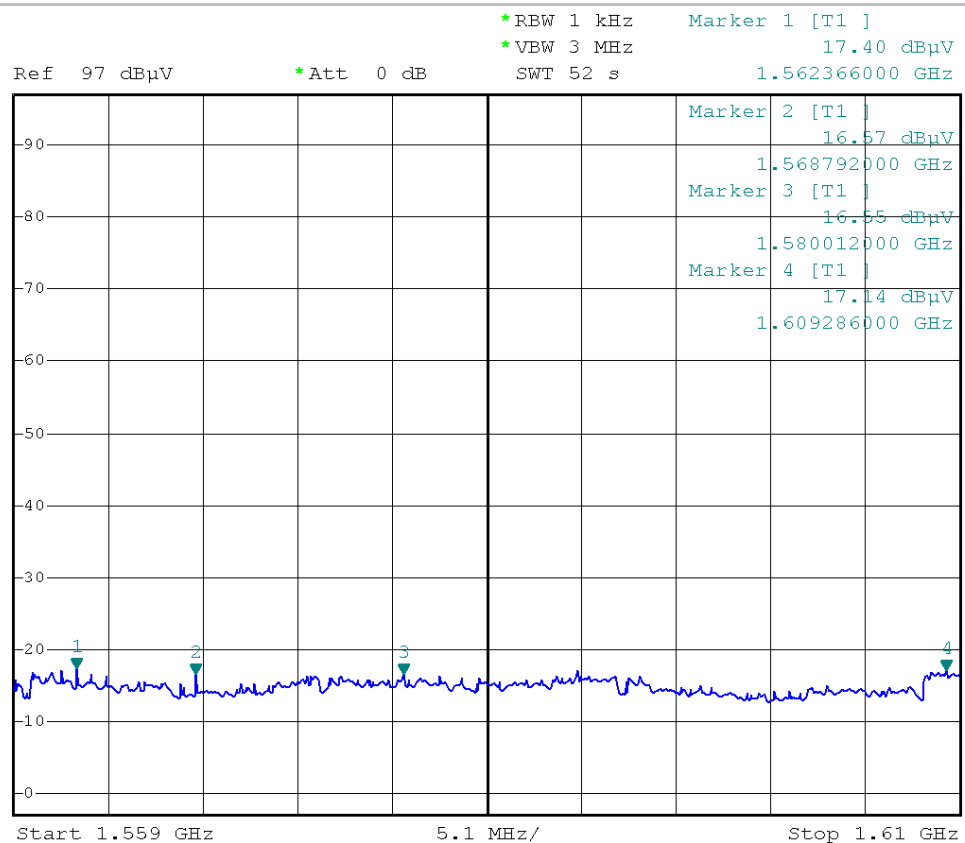
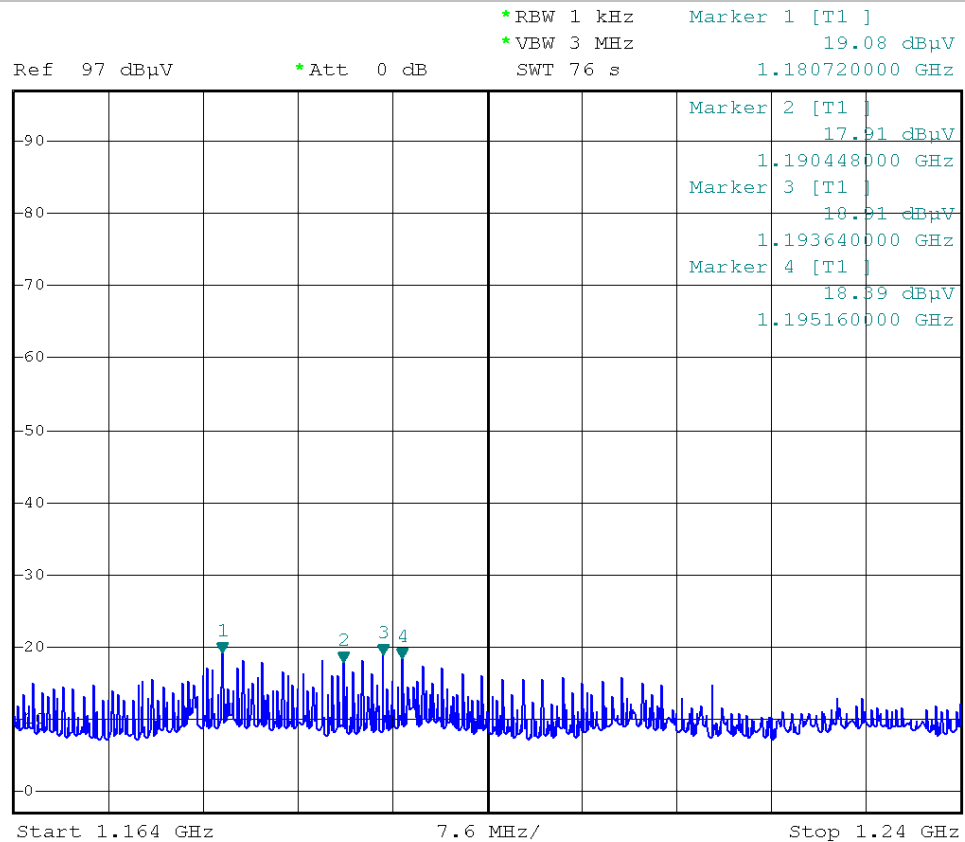
### GPS band 2

EUT Position (angle °)			315	Antenna Polarization			H
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
1562.37	17.40	25.30	1.68	38.85	5.53	29.40	-23.87
1568.79	16.57	25.30	1.68	38.85	4.70	29.40	-24.70
1580.01	16.55	25.30	1.68	38.85	4.68	29.40	-24.72
1609.28	17.14	25.50	1.68	38.85	4.88	29.40	-24.52

## TEST RESULT

The EUT meets the requirements of sections 15.509(d)

## TEST RESULT DETAIL



## 7.8 HIGHEST RADIATED EMISSION AT $f_M$

TEST REQUIREMENT	
Test definition	For UWB devices where the frequency at which the highest radiated emission occurs, $f_M$ , is above 960 MHz, there is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centred on $f_M$ .
Test setup	ANSI C63.4
Test facility	Open Area Test Site (OATS)
Test distance	3 meters
RBW bandwidth	1 MHz
VBW bandwidth	3 MHz
Detector	Peak
EUT operating condition	#1
Remark	None

LIMITS		
The peak emission level contained within a 50 MHz bandwidth centered on $f_M$ must be limited to a maximum of 0 dBm EIRP.		
EIRP limit (dBm)	Field strength limit @ 3 meters (dB $\mu$ V/m)	Field strength limit @ 3 meters (measured with 1 MHz RBW) (dB $\mu$ V/m)
0	95.2	61.2
<b>Note:</b> The limits were converted from EIRP to field strength at 3 meter according to FCC 15.503(k). As the measurement was employed with a 1 MHz resolution bandwidth the applicable limit is adjusted with a $20\log(1/50)$ dB factor.		

## TEST PROCEDURE

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

## SUMMARY OF TEST RESULT DATA

Maximum Peak emission contained within 50 MHz is found at the following test set-up conditions

EUT Position (angle °)			0	Antenna Polarization			V
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	Limit	Margin
(MHz)	(dBμV)	(dB1/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
208.12	43.88	9.80	0.54	0.00	54.22	61.20	-6.98

## TEST RESULT

The EUT meets the requirements of sections 15.509(f)

## 7.9 TECHNICAL REQUIREMENTS APPLICABLE TO ALL UWB DEVICES

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

### TEST RESULT

The EUT meets the requirements of sections 15.521.



## 7.10 COORDINATION REQUIREMENT

### TEST REQUIREMENT

- (a) UWB imaging systems require coordination through the FCC before the equipment may be used. The operator shall comply with any constraints on equipment usage resulting from this coordination.
- (b) The users of UWB imaging devices shall supply operational areas to the FCC Office of Engineering and Technology, which shall coordinate this information with the Federal Government through the National Telecommunications and Information Administration.
- (c) The manufacturers, or their authorized sales agents, must inform purchasers and users of their systems of the requirement to undertake detailed coordination of operational areas with the FCC prior to the equipment being operated.
- (d) Users of authorized, coordinated UWB systems may transfer them to other qualified users. and to different locations upon coordination of change of ownership or location to the FCC and coordination with existing authorized operations.
- (e) The FCC/NTIA coordination report shall identify those geographical areas within which the operation of an imaging system requires additional coordination or within which the operation of an imaging system is prohibited.
- (f) The coordination of routine UWB operations shall not take longer than 15 business days from the receipt of the coordination request by NTIA.

REQUIREMENT	DESCRIPTION
§ 15.525 § 15.509(b)	The responsible party is properly informed about the required coordination requirement and provide correct information to the customers and users about their specific care and legislative obligations. (See Important note for the US customers of the "STREAMX600 - User manual")

### TEST RESULT

The EUT meets the requirements of sections 15.525 and 15.509(b).

## 8. MEASUREMENTS AND TESTS UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the IMQ procedure No. IO-DT-U01 and requirement of NIST Technical Note 1297 and NIS 81: 1994 "The Treatment of Uncertainty in EMC Measurements"

Methods	Expanded Uncertainty	Unit	confidence level	Coverage factor	Degree of freedom
Radiated emission (30 ÷ 1000 MHz)	4.77	dB	95 %	2	9
Radiated emission (above 1000 MHz)	3.53	dB	95 %	2	9

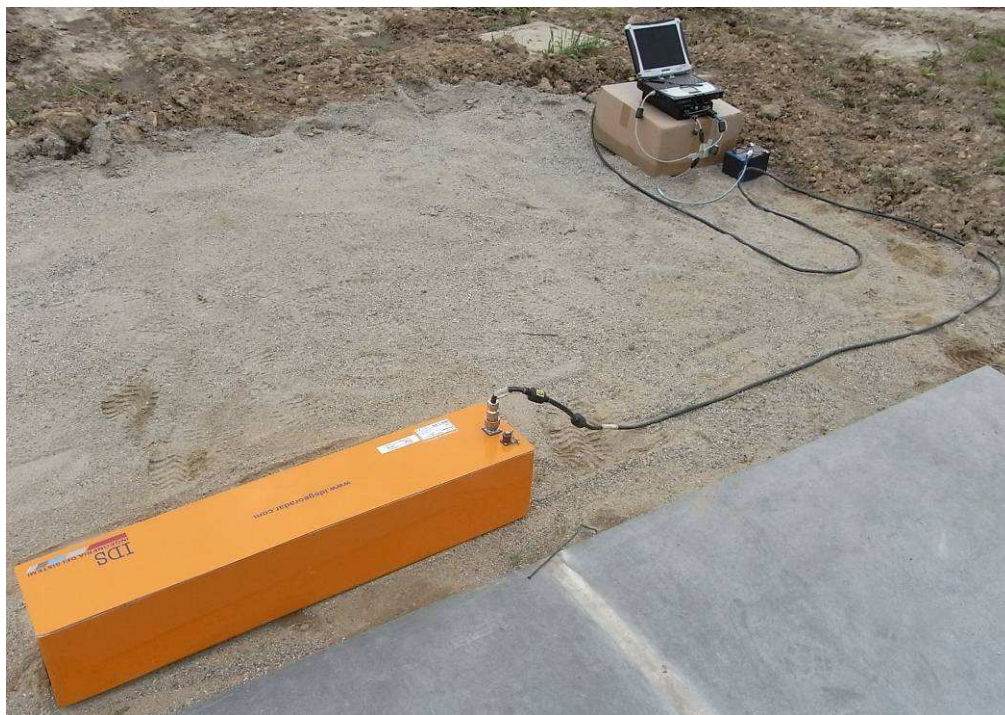
## 9. LIST OF MEASURING EQUIPMENT AND CALIBRATION INFORMATION

IMQ Serial Number	Instrument	Manufacturer	Type	Last Cal.	Cal. Period.	Calibration Company
S03463	Horn Antenna	Schwarzbeck	BBHA 9120D	06-09	36	NPL
S03511	Log-Per. Antenna	Ara	LPB-2520/1	06-09	36	NPL
S03629	Spectrum Analyzer	Rohde & Schwarz	FSP40	01-10	24	I.N.R.I.M.
S03542	Preamplifier	Hewlett Packard	HP 8449B	02-11	24	AGILENT
S04193	Preamplifier	Bonn Elektronik	BLNA 0110-15C35	02-11	24	DKD
S03745	Oscilloscope	Yokogawa	DL 7200	05-09	12	AVIATRONIK
S04159	Multimeter	Fluke	45	01-11	12	IMQ
S00735	Meter-graph	Salmoiraghi	1656/2B	02-11	12	IMQ

**Note:** The IMQ instruments are tested and calibrated according to UNI EN 45001, the IMQ procedure IP-037 "Calibration test equipment and measurement" and according to plans set on IMQ operating instruction IO-FT-034 "Criteria for the calibration of test equipment and measurement" which are an integral part of the Quality Manual of IMQ.

## 10. PHOTOGRAPHIC DOCUMENTATION

### EUT IDENTIFICATION





**SET-UP****Test set-up below 960 MHz****Test set-up above 960 MHz****END OF REPORT**