EMC TEST REPORT

TEST STANDARD(S)	:	ETSI EN 301 489-1: V2.2.3 ETSI EN 301 489-3: V2.3.2 ETSI EN 301 489-19 V2.1.1 ETSI EN 301 489-52: V1.2.1
CLIENT / APPLICANT	:	Robert Bosch (Pty) Ltd.
CLIENT ADDRESS	:	33 Piet Rautenbach Industrial Site Brits 0250
TEST SAMPLE (EUT)	:	Tracking Device
MODEL NUMBER	:	MK2
TEST RESULTS	:	Pass
REPORT NUMBER	:	TRE02193/23
DATE ISSUED	:	18/10/2023
REVISION	:	1.0

iSERT (Pty) Ltd. Test reports apply only to the specific sample(s) tested under stated conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to ensure that additional production units of this model are manufactured with identical electrical and mechanical components. iSERT (Pty) Ltd. Shall have no liability for any deductions, inference or generalizations drawn by the client or others from our Issued test reports. This report shall not be used to claim, constitute or imply a product endorsement from iSERT (Pty) Ltd.

This test report was prepared by: ***Name:*** *JA du Plooy*
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This test report was approved by: ***Name:*** *CJ Deysel*
Title: *Technical Director*

T0812

This test report is issued in accordance with SANAS accreditation requirements. SANAS is a signatory to the ILAC Mutual Recognition arrangement for the mutual recognition of the equivalence of testing and calibration reports

DOCUMENT CONTROL

Revision	Date	Author	Pages affected	Change proposal
1.0	18/10/2023	JA du Plooy	All	N/A

TEST LABORATORY INFORMATION

Established in 2017, iSERT (Pty) Ltd. Provides EMC, RF & Safety testing services by our skilled Engineers. Our services employ a wide variety of advanced cutting-edge test equipment with one of the widest ranges of accredited standards in the country.

The site and apparatus are constructed in conformance with the requirements of CISPR 16-1-4, EN 50147-1 and other equivalent standards. The laboratory is compliant with the requirements of ISO/IEC 17025

It is our definite objective to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with the best EMC, RF & Safety services by knowledgeable and accommodating staff.

Our test site is located at 129 Khai-Apple Street, Montana, Pretoria, South Africa 0186.

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DEFINITIONS & ACRONYMS

AE – Associated Equipment. Equipment needed to exercise and/or monitor the operation of the EUT.

AM – Amplitude Modulation

Antenna Port – Port, other than a broadcast receiver tuner port, for connection of an antenna used for intentional transmission and/or reception of radiated RF energy.

Broadcast Receiver Tuner Port – Port intended for the reception of a modulated RF signal carrying terrestrial, satellite and/or cable transmissions of audio and/or video broadcast and similar services.

Class A device – A device that is marketed for use in a commercial, industrial or business environment. A 'Class A' device should not be marketed for use by the general public. A 'Class A' device should contain the following warning in its user manual: "Warning: Operation of this equipment in a residential environment could cause radio interference."

Class B device – A device that is marketed for use in a residential environment and may also be used in a commercial, business or industrial environment. NOTE: A residential environment is an environment where the use of broadcast radio and television receivers may be expected within a distance of 10m of the device concerned.

EMC – Electro-Magnetic Compatibility. The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

EMI – Electro-Magnetic Immunity. The ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.

EUT – Equipment Under Test. A device or system being evaluated for compliance that is representative of a product to be marketed.

ITE – Information Technology Equipment. Has a primary function of entry, storage, display, retrieval, transmission, processing, switching, or control of data and/or telecommunication messages and which may be equipped with one or more ports typically for information transfer.

LISN – Line Impedance Stabilization Network

NA – Not Applicable

NCR – No Calibration Required

NSA – Normalized Site Attenuation

Optical Fiber Port – Port at which an optical fiber is connected to an equipment.

RF – Radio Frequency

Signal/Control Port – Port intended for the interconnection of components of an EUT, or between an EUT and local AE and used in accordance with relevant functional specifications (for example for the maximum length of cable connected to it). (Examples include: RS-232, USB, HDMI, Fire Wire)

Wired Network Port – Point of connection for voice, data and signaling transfers intended to interconnect widely dispersed systems by direct connection to a single-user or multi-user communication network. (Examples include: CATV, PSTN, ISDN, xDSL, LAN and similar networks)

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1. INTRODUCTION

This report details the results of tests performed on the Robert Bosch Tracking device with model number: MK2. The testing was carried out between the 07/08/2023 and 16/10/2023 at the iSERT laboratory. Testing was conducted by Altus du Plooy.

2. STANDARDS APPLIED

1. ETSI EN 301 489-1 V2.2.3 (2019-11) 'Electromagnetic compatibility and Radio Spectrum Matters (ERM)

2. ETSI EN 301 489-3 V2.3.2 (2023-01) 'Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 40 GHz'.

3. ETSI EN 301 489-19 V2.1.1 (2019-04).'Specific conditions for Receive Only Mobile Earth Stations (ROMES) operating in the 1,5GHz band providing data communications and GNSS receivers operating in the RNSS band (ROGNESS) providing positioning, navigation, and timing data'.

4. ETSI EN 301 489-52 V1.2.1 (2021-11) 'Specific conditions for Cellular Communications Mobile and portable (UE) radio and ancillary equipment.

3. SUMMARY OF TEST RESULTS

No.	Test Standard	Description	Results
Section A - Emissions			
1.	EN 55032 / CISPR 32	Radiated emissions: 30 – 1000MHz	✓
2.	EN 55032 / CISPR 32	Radiated emissions: 1 – 6GHz	✓
3.	EN 55032 / CISPR 32	Conducted emissions AC / DC adaptor input power	N/A (1)
4.	EN / IEC 61000-3-2	Harmonic current emissions	N/A (1)
5.	EN / IEC 61000-3-3	Voltage fluctuation & flicker	N/A (1)
Section B - Immunity			
6.	EN / IEC 61000-4-2	Immunity to Electrostatic discharge	✓
7.	EN / IEC 61000-4-3	Immunity to Radiated Electromagnetic Fields	✓
8.	EN / IEC 61000-4-4	Immunity to Electrical Fast Transient	N/A (1)
9.	EN / IEC 61000-4-5	Immunity to Surges	N/A (1)
10.	EN / IEC 61000-4-6	Immunity to Conducted Disturbances	N/A (1)
11.	EN / IEC 61000-4-11	Voltage dips	N/A (1)
12.	EN / IEC 61000-4-11	Voltage interruptions	N/A (1)

Note 1: This specific test standard is not applicable for this type of EUT

4. CONCLUSION

Based on the results of our investigation, we have concluded that the EUT (in the configuration tested) complies with the requirements of the standard(s) indicated above. The results obtained in this test report are only valid for the item(s) tested. iSERT (Pty) Ltd. does not make any claims of compliance for samples or variants which were not tested.

5. EMISSION CLASSES AND IMMUNITY CRITERIA

5.1 EMISSIONS

CISPR 32 / EN 55032 defines Class A equipment and Class B associated with two types of end-user environment.

The Class B requirements for equipment are intended to offer adequate protection to broadcast services within the residential environment.

Equipment intended primarily for use in a residential environment shall meet the Class B limits. All other equipment shall comply with the Class A limits.

Broadcast receiver equipment is class B equipment.

NOTE: Equipment meeting Class A requirements may not offer adequate protection to broadcast services within a residential environment.

Class A equipment shall have the following warning in the instructions for use, to inform the user of the risk of operating this equipment in a residential environment:

Warning:

This equipment is compliant with Class A of CISPR 32 / EN 55032. In a residential environment this equipment may cause interference

5.2 IMMUNITY

Description of performance criteria:

A: No loss of performance or function

B: Temporary loss of function or performance which is self-recoverable

C: Temporary loss of function or performance which requires operator intervention or system reset

D: Loss of function which is not recoverable

5.2.1 Classification of SRD equipment

The product family of short-range devices is divided by device type, each having its own set of performance criteria. This classification is based upon the impact on persons and / or goods in case the equipment does not operate above the specified performance level under EMC stress.

5.3 ENVIRONMENTAL CONDITIONS DURING ESD TEST:

Temperature	Relative Humidity
21.5°C	41%

5.4 CALIBRATION OF TEST EQUIPMENT

The calibration of the test equipment is performed by a SANAS accredited laboratory and is traceable to the national standards maintained by NMISA.

5.5 MEASUREMENT OF UNCERTAINTY

ISO / IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions results be included in the test report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor of k = 2)

Measurement Uncertainty		
Test Item	**Frequency**	**Uncertainty (dB)**
Conducted Emissions from the AC mains power ports	150kHz – 30MHz	3.4
Radiated Emissions - Horizontal	> 200 MHz	4.84
	< 200 MHz	4.84
Radiated Emissions - Vertical	> 200 MHz	4.96
	< 200 MHz	5.16

In cases where the measured results are below the specification limit by a margin less than the measurement uncertainty it is not possible to state outright compliance based on the 95% level of confidence. The result, however, indicates that compliance is more probable than non-compliance with the specification limit.

Determining compliance with the limits in this standard shall be based on the results of the compliance measurement, not considering measurement instrumentation uncertainty.

5.5.1 Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF – AG

Where: FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBµV/m.

6. TECHNICAL INFORMATION

6.1 EQUIPMENT UNDER TEST (EUT) DETAILS

EUT name:	Tracking Device
Model number(s):	MK2
Radio Module: (Sigfox/LoRaWAN)	Seongji LSM100A
Radio Module: (Cellular/GPS)	Quectel BG600L-M3
Power Ratings:	3.7V Li-ion Battery

6.2 SUPPORT EQUIPMENT

Product Type	Manufacturer	Model number
Laptop	Lenovo	Gaming 3 16IAH7
SDR Dongle	Sigfox	00001F84

6.3 EUT TEST SETUP DETAIL AND OPERATING CONDITION

The specific test methodology will be discussed under each relevant test if different to the general set-up guidelines below.

6.3.1 Emissions

1. The EUT test modes were adapted accordingly in reference to the instructions for use.
2. Tests were performed while the device was fully operational.
3. The equipment under test (EUT) was configured to measure its highest possible radiation level.
4. Deviations from the above set-up will be noted in each specific case.

6.3.2 Immunity

1. The equipment under test (EUT) was configured to have its highest possible susceptibility against the tested phenomena.
2. The test modes were adapted accordingly in reference to the instructions for use.
3. Different configurations were used to obtain the most susceptible setup.

6.4 EUT MODE OF OPERATION

The EUT was tested in the following modes of operation:

No.	Mode	Description
1.	868MHz (Sigfox/LoRa) Cellular (2G/NB-IoT) GPS	The EUT was powered and fully operational during testing. The EUT was configured to transmit on 868MHz at regular intervals. A Sigfox SRD dongle was used to validate the quality of the message. A communications link was set up with a Rohde & Schwartz CMW 500 base station simulator in the variance cellular bands. The EUT was commanded in maximum transmit power. The downlink RXQUAL was closely monitored for signs of susceptibility. A communications link was set up with an Amari Callbox Mini base station simulator in the variance cellular bands. The EUT and communication link were verified via a status display. The GPS function of the EUT was exercised using a GPS re-radiator positioned inside the anechoic test chamber. The message memory was loaded with recognizable messages. The EUT was closely monitored for signs of susceptibility.

6.5 DEVICE IMAGES

Figure 1: Top view

Figure 2: Bottom view

Figure 3: Left view

Figure 4: Right view

6.6 TEST EQUIPMENT LIST

No.	Equipment description	Serial number	Cal Due date
1.	California Instruments Model 4503L AC Power system	HK50775	Internal verification
2.	Bulk Current Injection Probe CLCI-100	581149	Internal verification
3.	RF Current Injection Probe	561383	Internal verification
4.	M2 & M3 Coupling / de-Coupling Network CDN-M325E	521169	Internal verification
5.	Telecommunications Coupling / de-Coupling Network CDN-T8SE	511434	Internal verification
6.	Combilog Antenna AC-200	061128	July 2027
7.	TESEQ NSG 3040 EMC Immunity Test System	6074	June 2024
8.	TESEQ CDN 3425 Capacitive clamp	3082	Inter-laboratory comparison
9.	TESEQ NSG 435 ESD Gun	7184	August 2024
10.	RS Pro ICM 33II Clamp meter	74700018	June 2024
11.	Agilent 83620B Signal Generator (10MHz – 20GHz)	98091	October 2023
12.	Rohde & Schwarz Universal communication tester – CMU200	103025	October 2023
13.	Rohde & Schwarz Wideband Radio Communication Tester – CMW500	112781	October 2023
14.	Rohde & Schwarz SML02 Signal generator	100045	October 2023
15.	Rohde & Schwarz NRVD Power meter	100686	October 2023
16.	Rohde & Schwarz NRV-Z4 Power meter sensor	191130	October 2023
17.	Narda EP-600 Electric Field probe	611WX70397	Inter-laboratory comparison
18.	AFJ LISN LS16C\10	16011850466	Inter-laboratory comparison
19.	Thurlby Thandar HA1600A Power & harmonics analyzer	479560	October 2024
20.	AH Systems SAS-571	2455	March 2027
21.	Kalmus 7100LC 100-Watt Amplifier (80MHz – 1GHz)	7439-1	No calibration required
22.	Kalmus 757LC 75-Watt Amplifier (10kHz – 1GHz)	7591	No calibration required
23.	Milmega Dual Band AS0760 Series amplifier (0.7 – 6GHz)	ISQ0008	No calibration required
24.	Fluke 115 Multi-meter	3451488WS	November 2023
25.	AFJ FFT3010 EMI analyzer	301017460136	August 2024
26.	Keysight N9020A EMI Signal analyzer: ATO-8599	MY52330018	June 2024
27.	Flus Humidity and temperature meter: ET-951W	2015106449	November 2023
28.	Com-Power EM Clamp CLEM-6146	16030004	Internal verification
29.	HP EPM-441A Power meter	GB37170880	October 2023
30.	HP 8482A Power sensor	2349A10222	October 2023

7. EMISSIONS

7.1 RADIATED EMISSIONS:

Method: Measurements were made in an 8-meter fully anechoic chamber that complies to CISPR 16. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meters. The limit line was adjusted accordingly. The EUT was rotated 360° about its azimuth with the receive antenna located at a fixed height in horizontal and vertical polarities. Final measurements (quasi-peak) were then performed by rotating the EUT 360°. All frequencies within 10 dB of the limit were investigated in both horizontal and vertical antenna polarity, where applicable.

7.1.1 Test set-up

a. The EUT was tested within its intended operating conditions as specified by the manufacturer.
b. Automated scans in the frequency band 30MHz to 6000MHz (radiated emissions) were done to determine compliance emission results for the EUT.
c. The EUT was tested in both horizontal and vertical polarizations.

7.1.2 FAR Radiated Emissions limits below 1GHz

Frequency (MHz)	Detector type	Class A (dBµV/m)	Class B (dBµV/m)
30 - 230	Quasi Peak	52 to 45	42 to 35
230 - 1000	Quasi Peak	52	42

7.1.3 FAR Radiated Emissions limits above 1GHz

Frequency (MHz)	Detector type	Class A (dBµV/m)	Class B (dBµV/m)
1000 - 3000	Peak	76	70
3000 - 6000	Peak	80	74
1000 - 3000	Average	56	50
3000 - 6000	Average	60	54

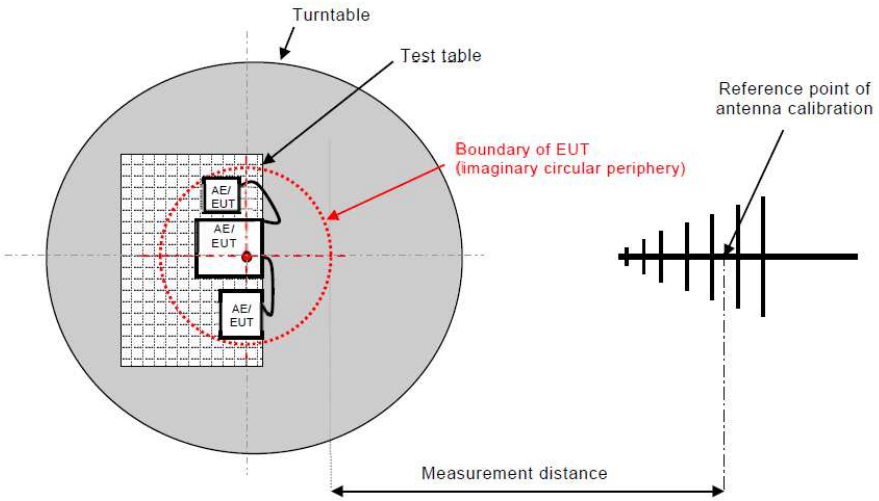
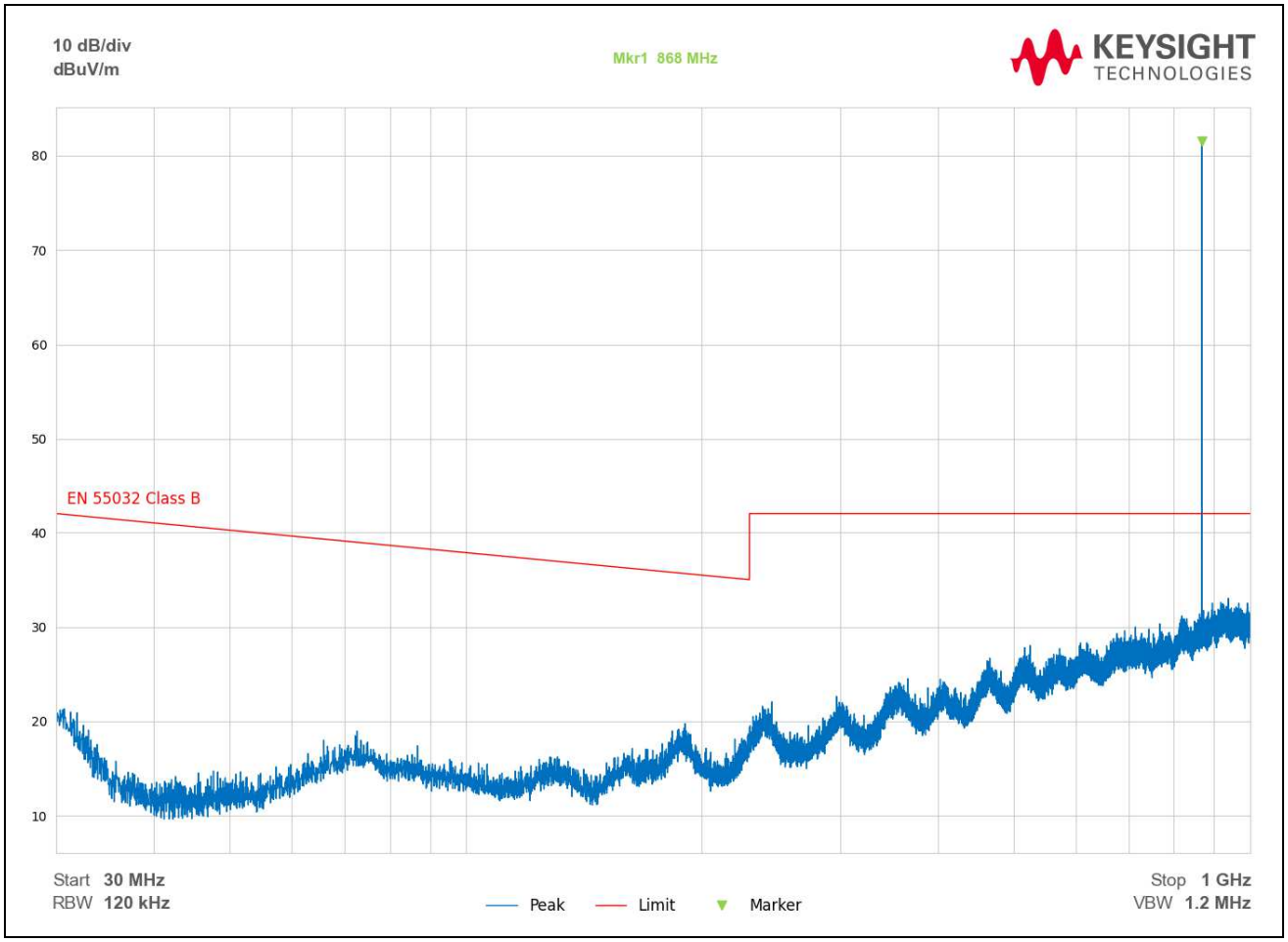


Figure 5: Typical Radiated emissions setup

7.1.4 Radiated Emission: 30MHz – 1000MHz

Graph 1: Represents radiated emissions measured from the EUT in the horizontal polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active 868MHz (Sigfox) and GPS



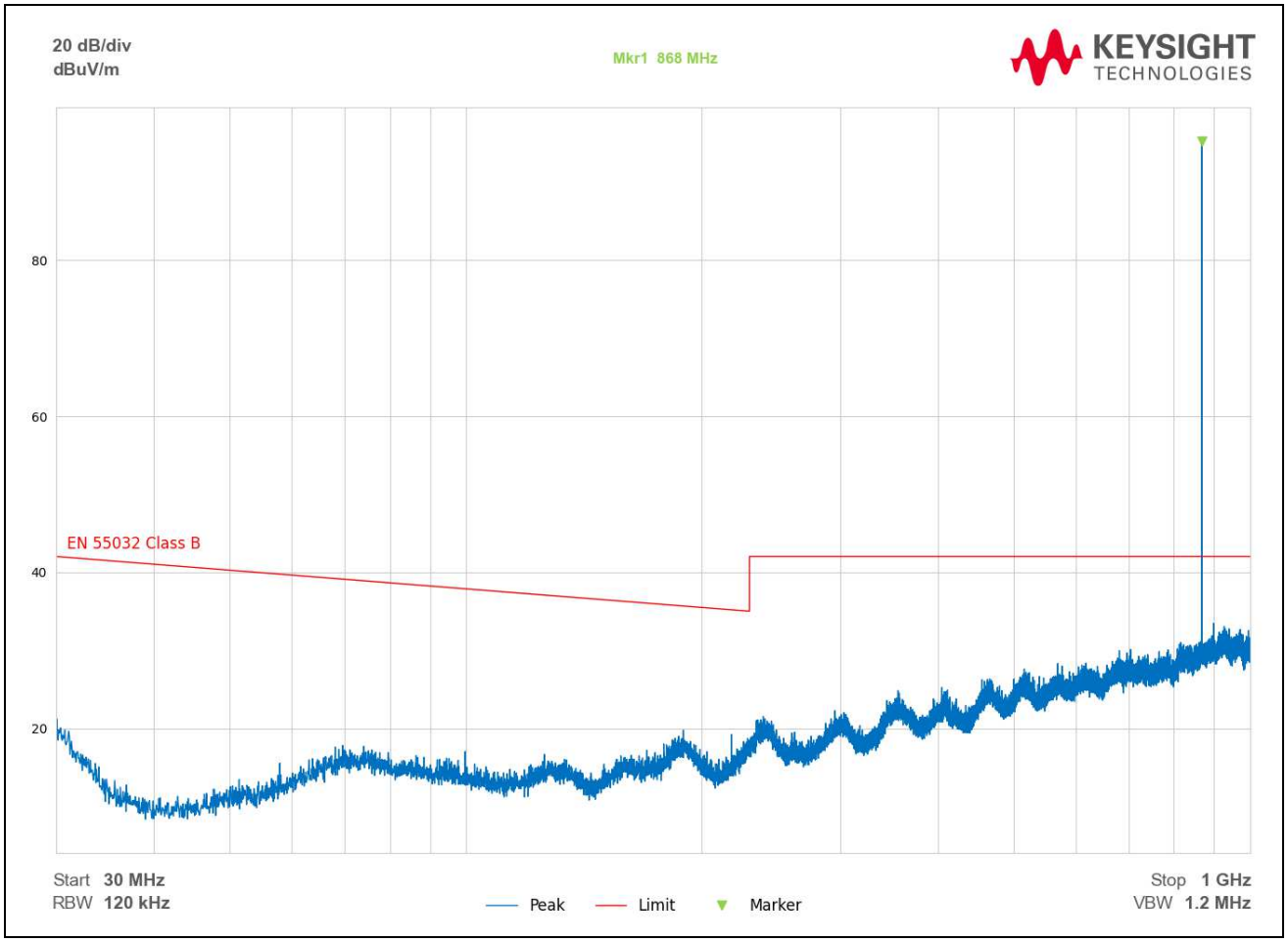
Graph 1: Radiated emissions results

Note: The 868MHz peak that exceeds the limit line is the transmit signal of the device and should be ignored.

7.1.5 Radiated Emission: 30MHz – 1000MHz

Graph 2: Represents radiated emissions measured from the EUT in the vertical polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active 868MHz (Sigfox) and GPS



Graph 2: Radiated emissions results

Note: The 868MHz peak that exceeds the limit line is the transmit signal of the device and should be ignored.

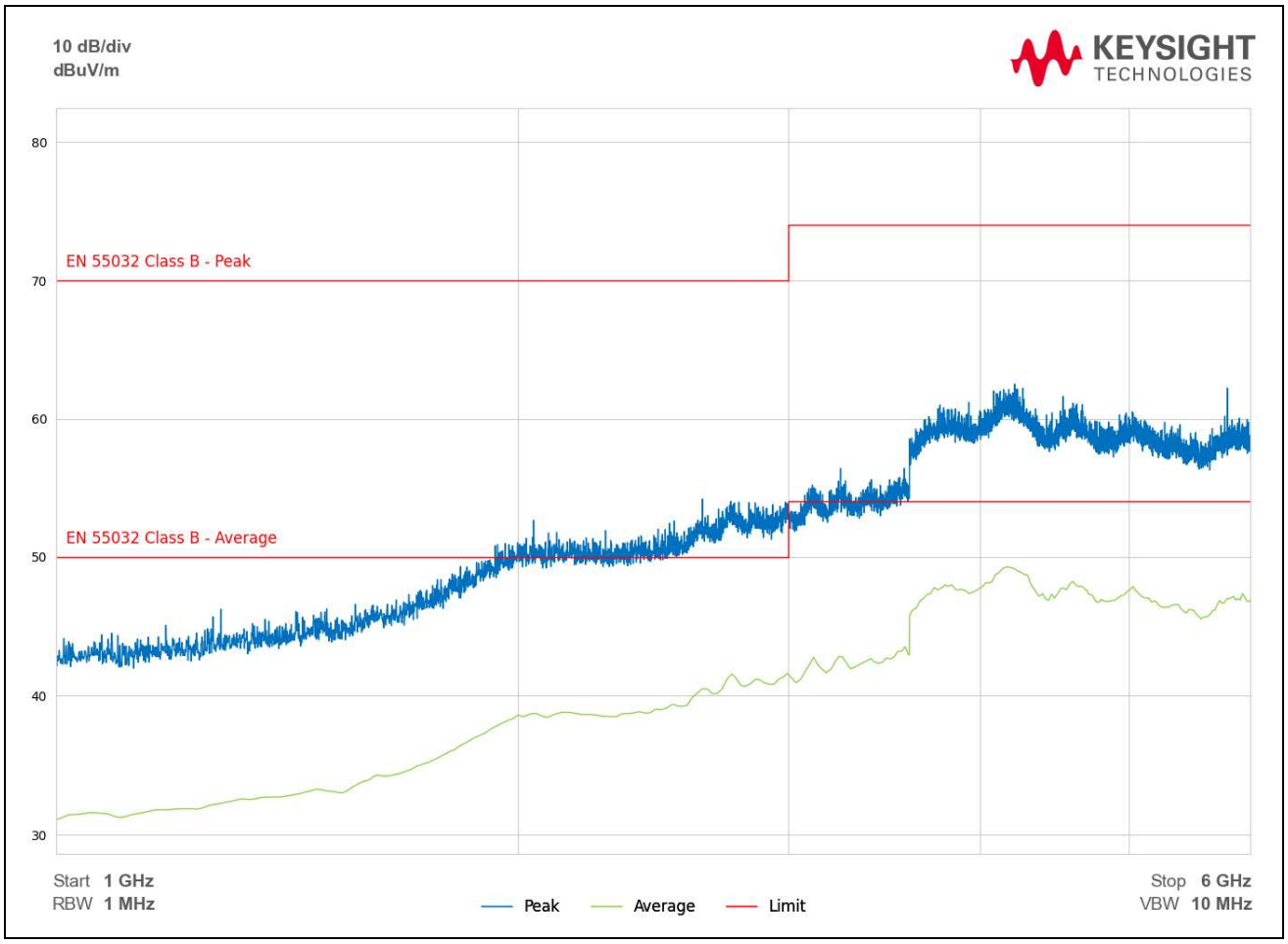
7.1.6 Conclusion

- The EUT complies with the radiated emissions requirements of EN 55032 / CISPR 32 for Class B devices.

7.1.7 Radiated Emission: 1000MHz – 6000MHz

Graph 3: Represents peak and average radiated emissions measured from the EUT in the Horizontal polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active 868MHz (Sigfox) and GPS

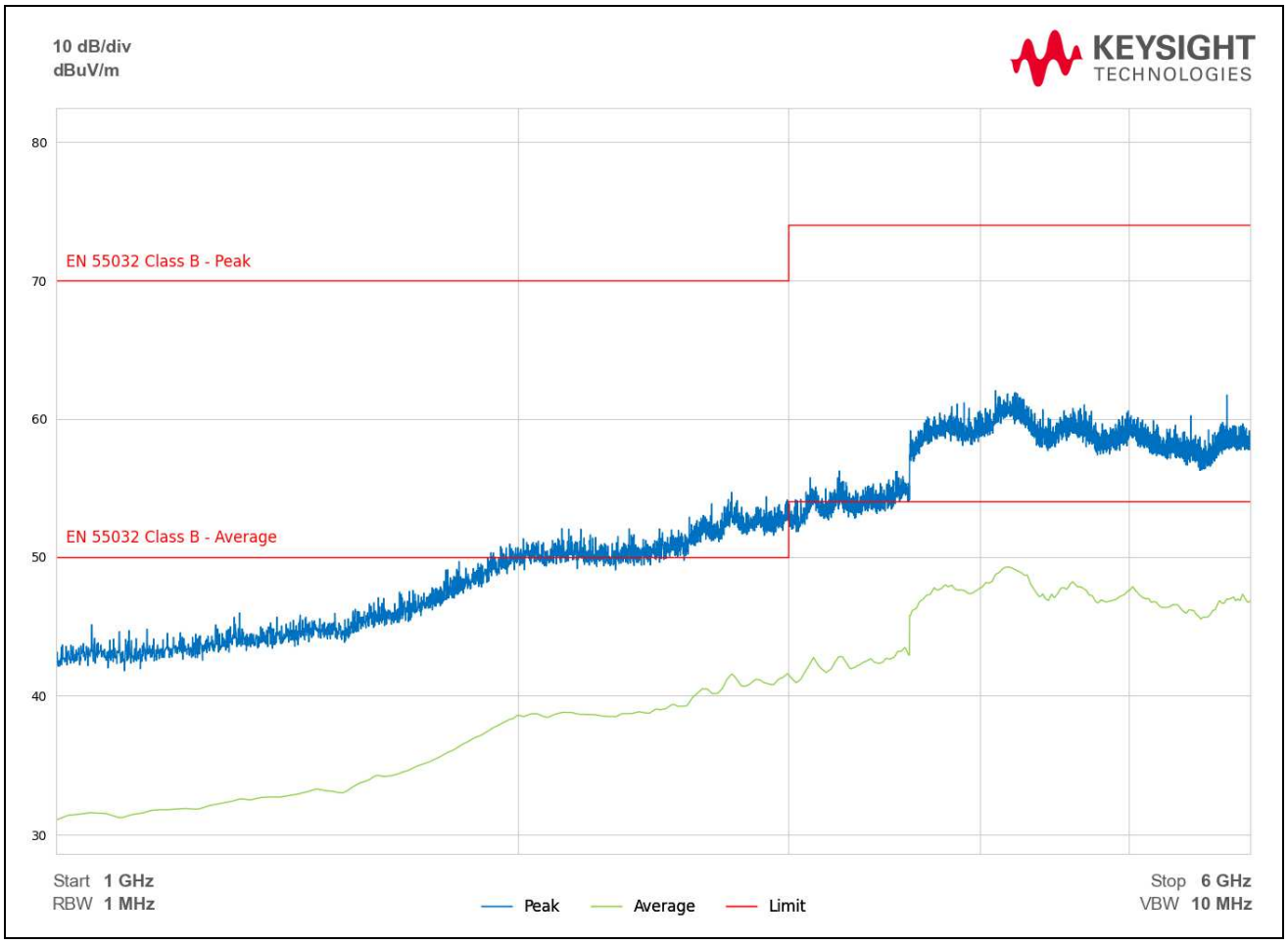


Graph 3: Radiated emissions results

7.1.8 Radiated Emission: 1000MHz – 6000MHz

Graph 4: Represents peak and average radiated emissions measured from the EUT in the vertical polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active 868MHz (Sigfox) and GPS



Graph 4: Radiated emissions results

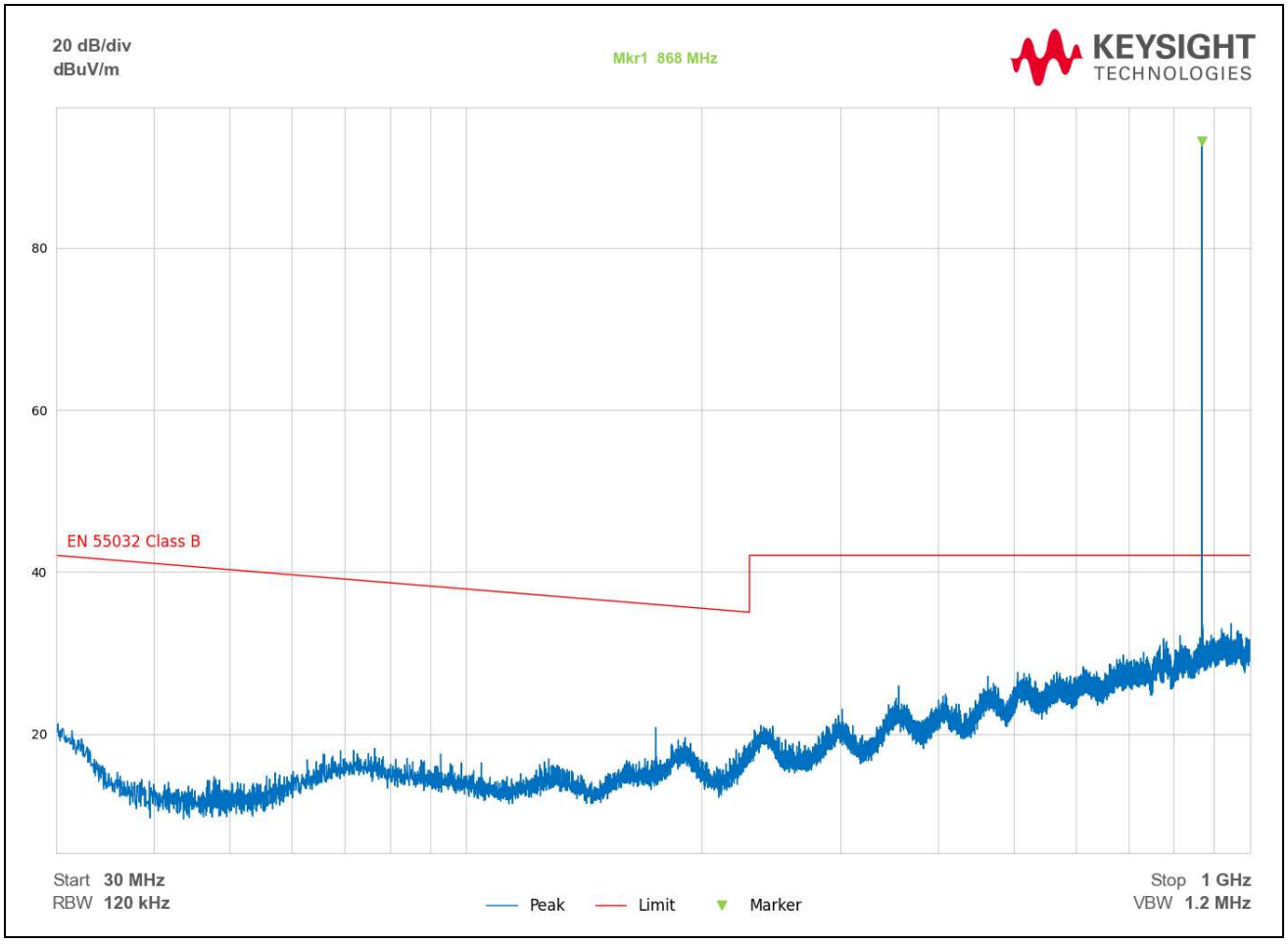
7.1.9 Conclusion

- The EUT complies with the radiated emissions requirements of EN 55032 / CISPR 32 for Class B devices.

7.1.10 Radiated Emission: 30MHz – 1000MHz

Graph 5: Represents radiated emissions measured from the EUT in the horizontal polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active 868MHz (LoRa) and GPS



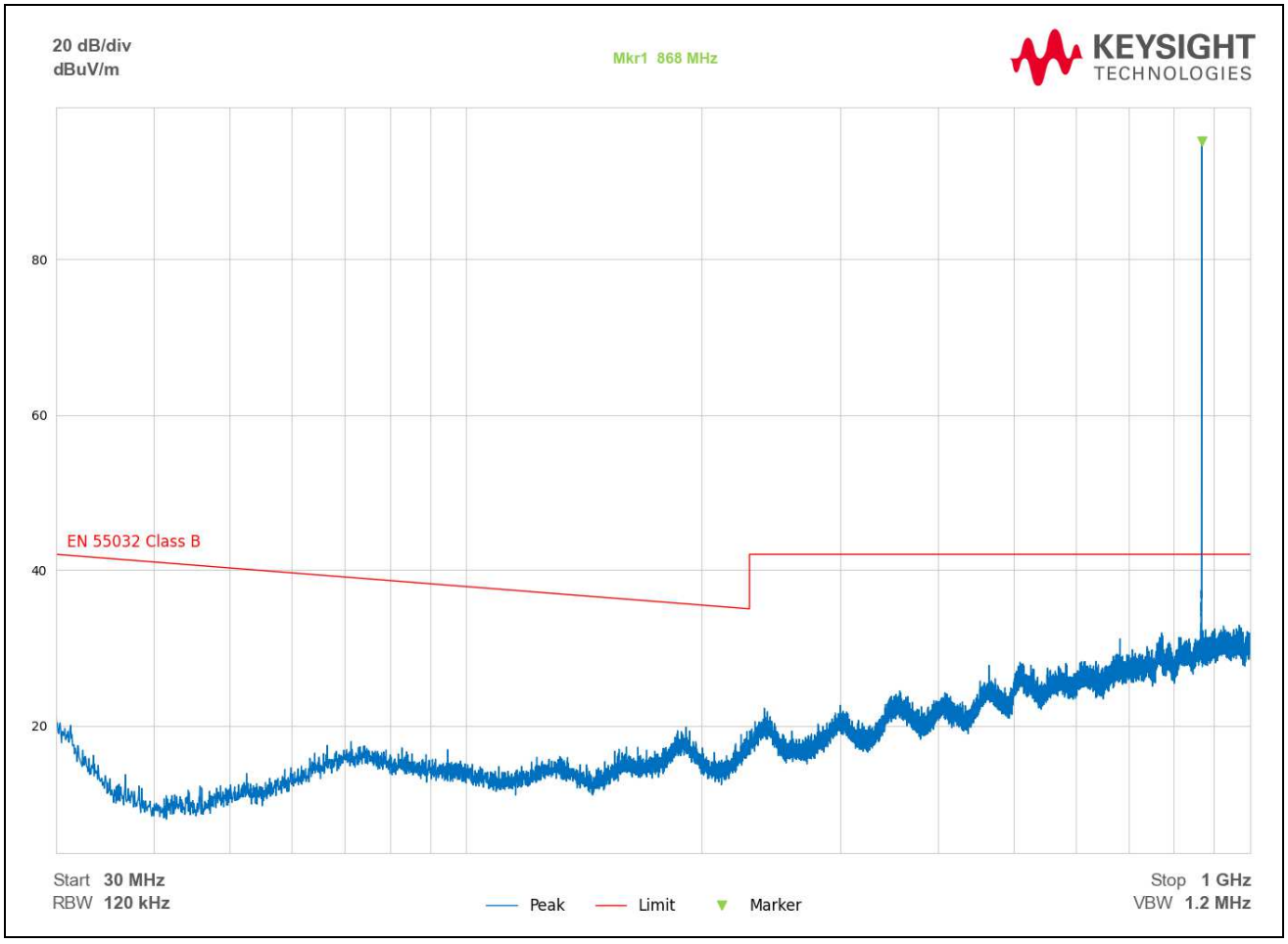
Graph 5: Radiated emissions results

Note: The 868MHz peak that exceeds the limit line is the transmit signal of the device and should be ignored.

7.1.11 Radiated Emission: 30MHz – 1000MHz

Graph 6: Represents radiated emissions measured from the EUT in the vertical polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active 868MHz (LoRa) and GPS



Graph 6: Radiated emissions results

Note: The 868MHz peak that exceeds the limit line is the transmit signal of the device and should be ignored.

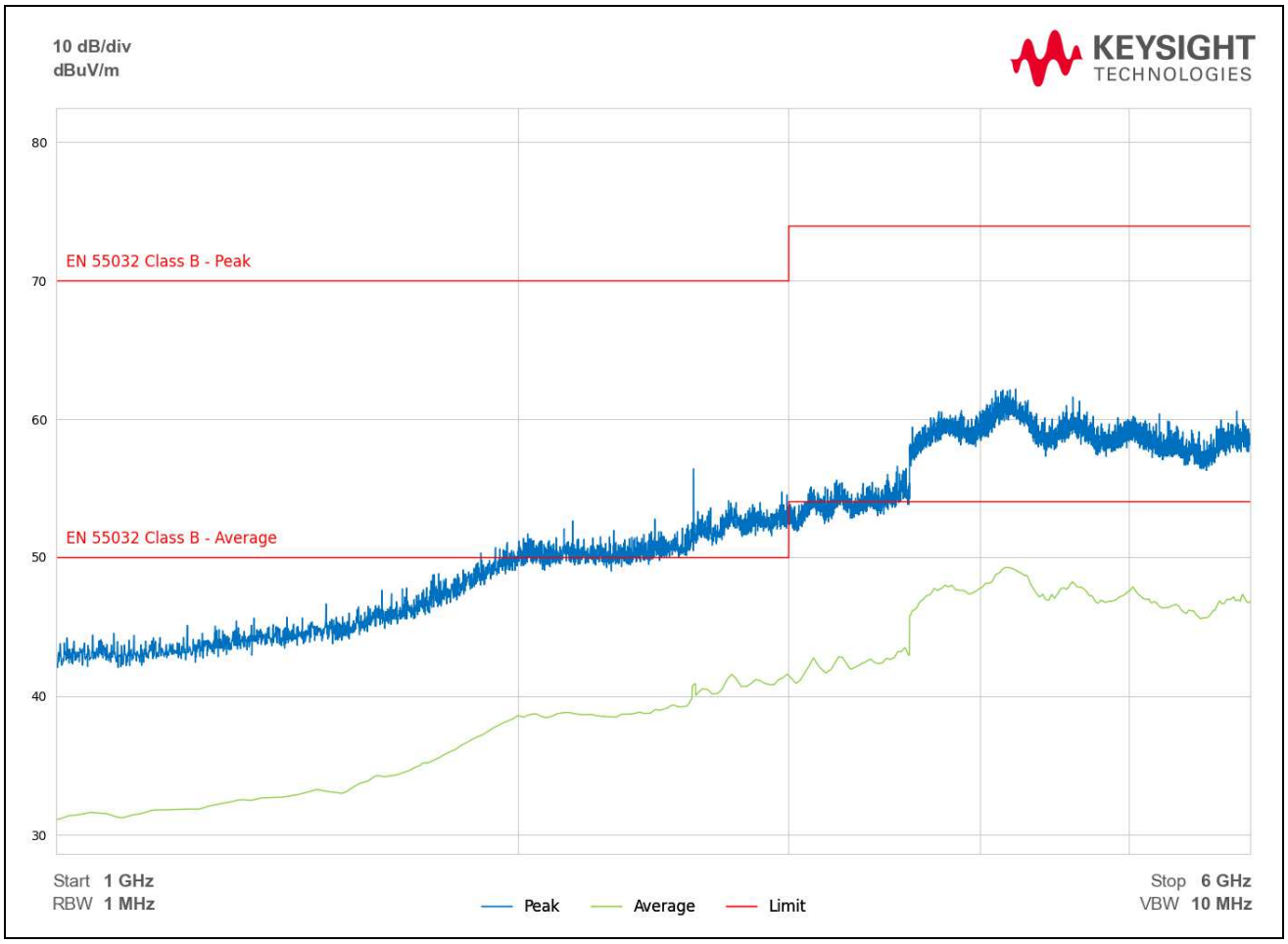
7.1.12 Conclusion

- The EUT complies with the radiated emissions requirements of EN 55032 / CISPR 32 for Class B devices.

7.1.13 Radiated Emission: 1000MHz – 6000MHz

Graph 7: Represents peak and average radiated emissions measured from the EUT in the Horizontal polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active 868MHz (LoRa) and GPS

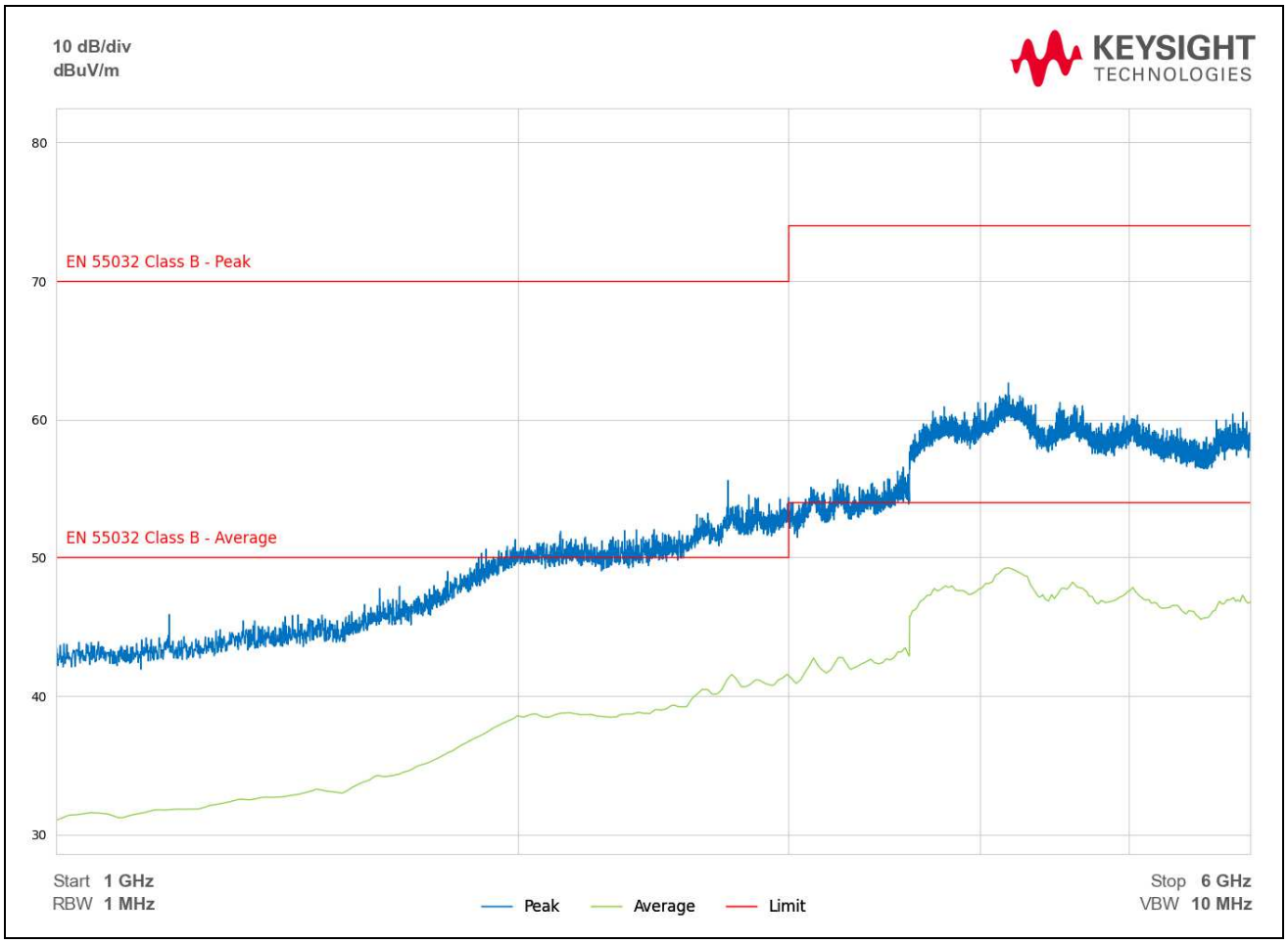


Graph 7: Radiated emissions results

7.1.14 Radiated Emission: 1000MHz – 6000MHz

Graph 8: Represents peak and average radiated emissions measured from the EUT in the vertical polarization

Power supply: 3.7Vdc Internal battery
Test Condition: Active 868MHz (LoRa) and GPS



Graph 8: Radiated emissions results

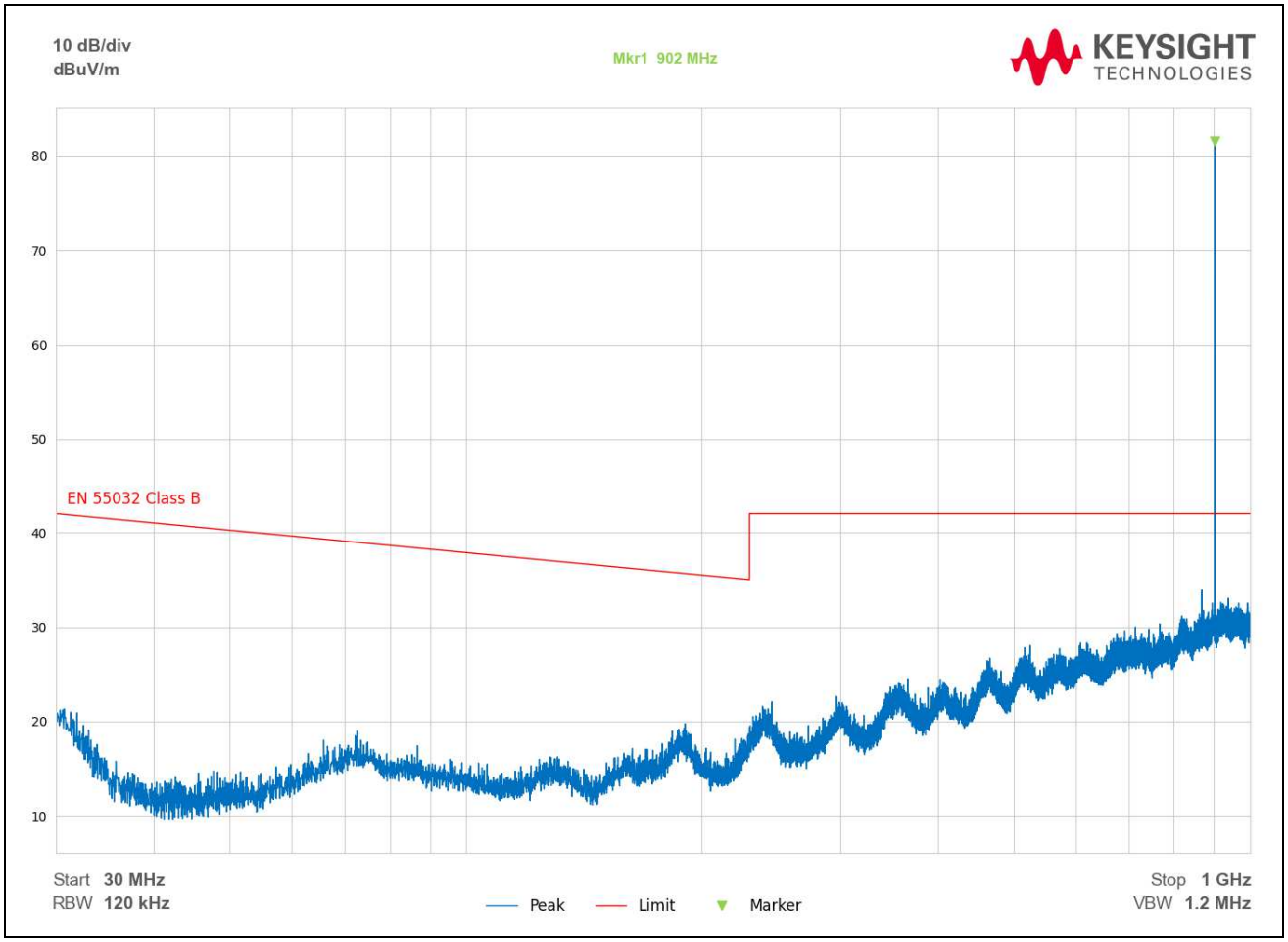
7.1.15 Conclusion

- The EUT complies with the radiated emissions requirements of EN 55032 / CISPR 32 for Class B devices.

7.1.16 Radiated Emission: 30MHz – 1000MHz

Graph 9: Represents radiated emissions measured from the EUT in the horizontal polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active Cellular (2G) and GPS



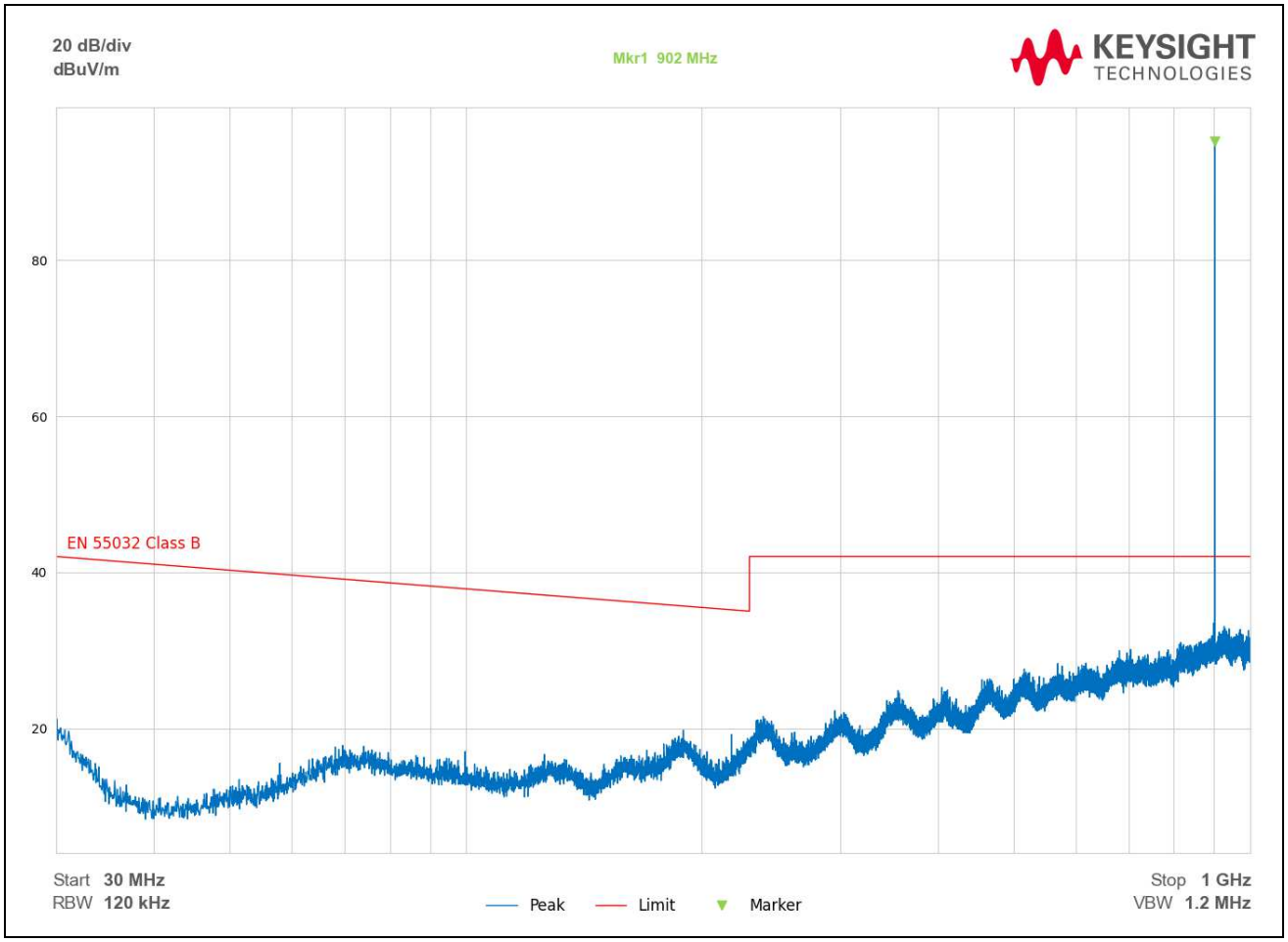
Graph 9: Radiated emissions results

Note: The 902MHz (2G) peak that exceed the limit line is the uplink of the device and should be ignored.

7.1.17 Radiated Emission: 30MHz – 1000MHz

Graph 10: Represents radiated emissions measured from the EUT in the vertical polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active Cellular (2G) and GPS



Graph 10: Radiated emissions results

Note: The 902MHz (2G) peak that exceed the limit line is the uplink of the device and should be ignored.

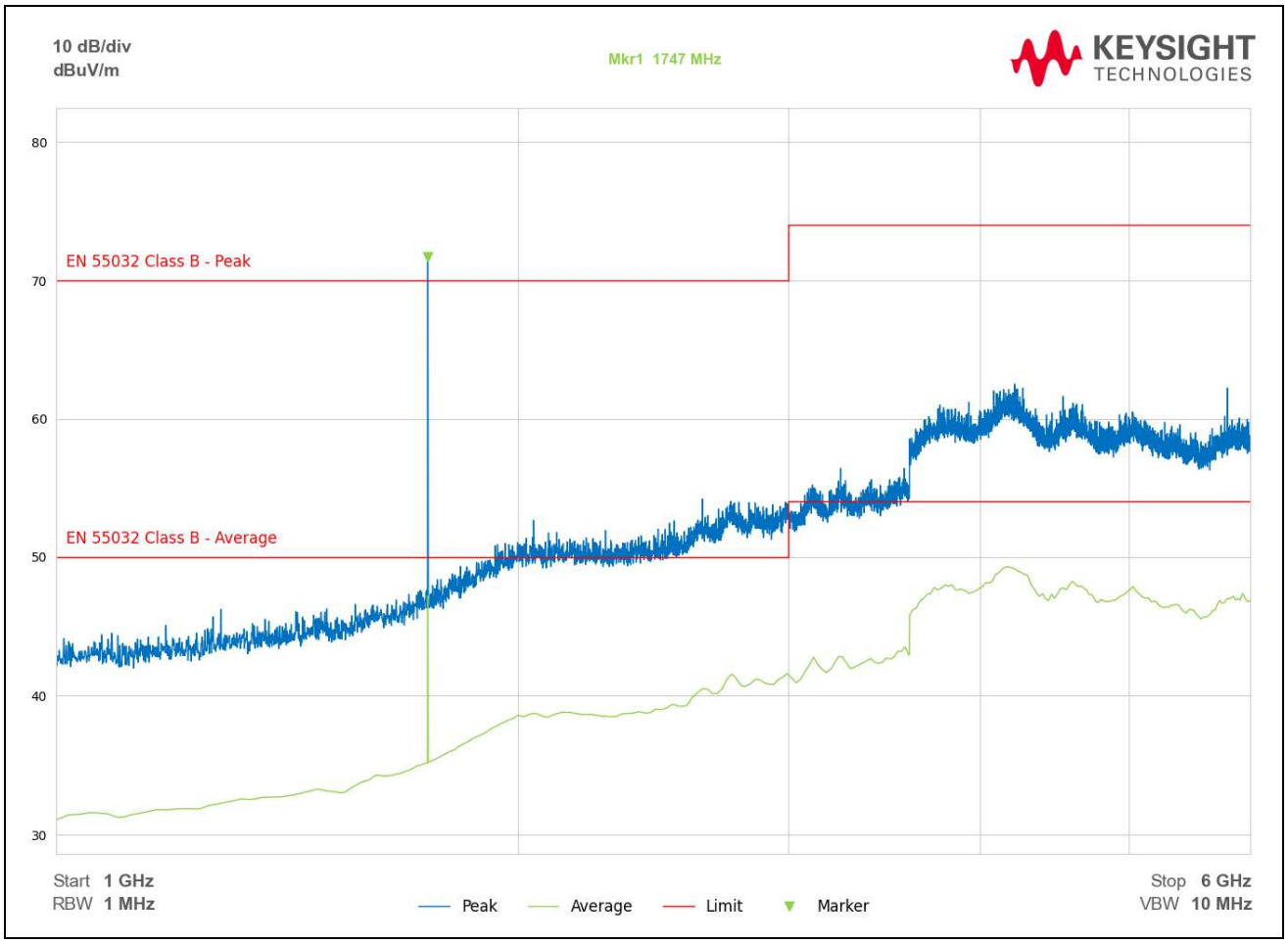
7.1.18 Conclusion

- The EUT complies with the radiated emissions requirements of EN 55032 / CISPR 32 for Class B devices.

7.1.19 Radiated Emission: 1000MHz – 6000MHz

Graph 11: Represents peak and average radiated emissions measured from the EUT in the Horizontal polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active Cellular (2G) and GPS



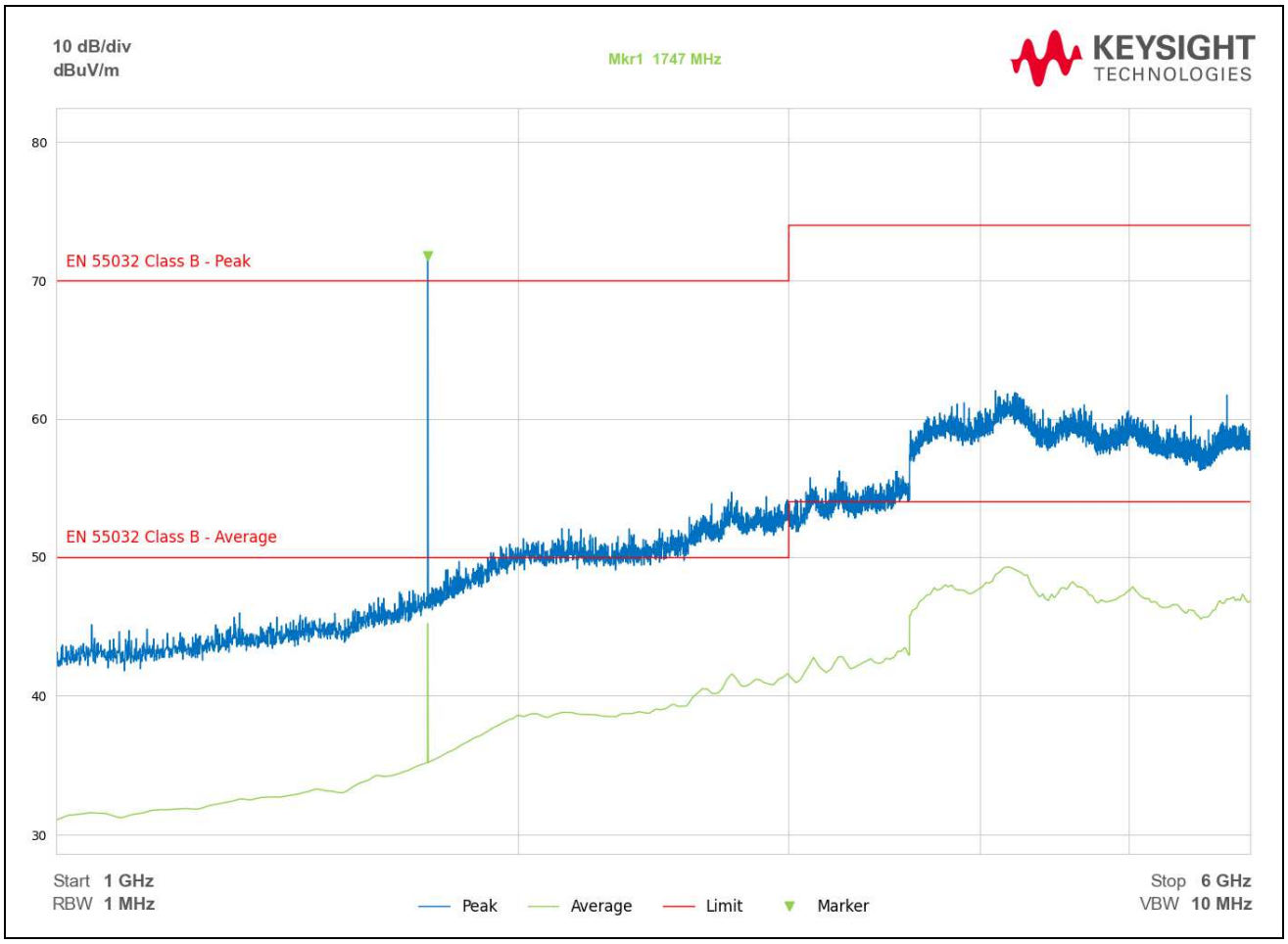
Graph 11: Radiated emissions results

Note: The 1.75GHz (2G) peak that exceed the limit line is the uplink of the device and should be ignored.

7.1.20 Radiated Emission: 1000MHz – 6000MHz

Graph 12: Represents peak and average radiated emissions measured from the EUT in the vertical polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active Cellular (2G) and GPS



Graph 12: Radiated emissions results

Note: The 1.75GHz (2G) peak that exceed the limit line is the uplink of the device and should be ignored.

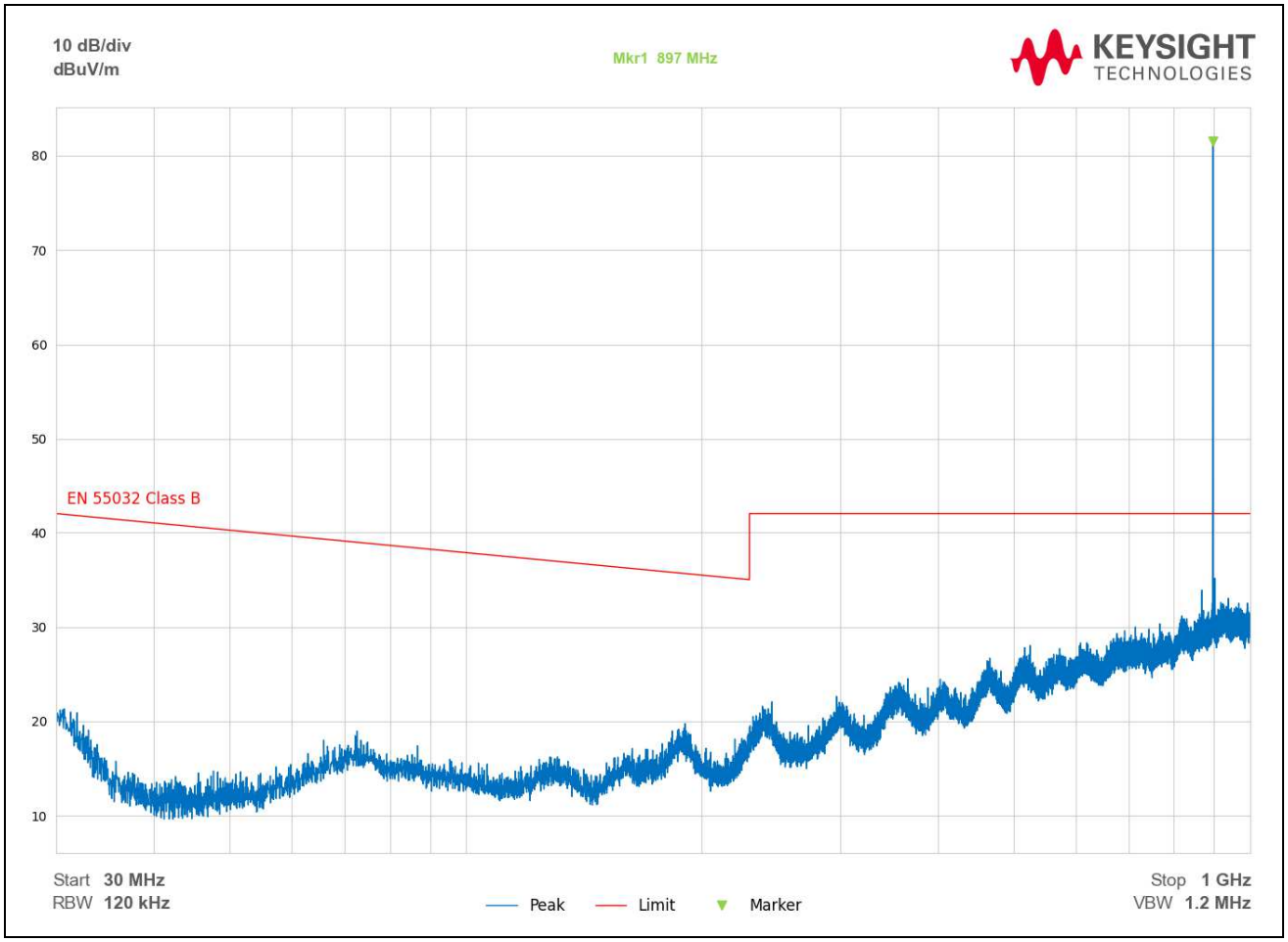
7.1.21 Conclusion

- The EUT complies with the radiated emissions requirements of EN 55032 / CISPR 32 for Class B devices.

7.1.22 Radiated Emission: 30MHz – 1000MHz

Graph 13: Represents radiated emissions measured from the EUT in the horizontal polarization

Power supply: 3.7Vdc Internal battery
Test Condition: Active Cellular (NB-IoT) and GPS



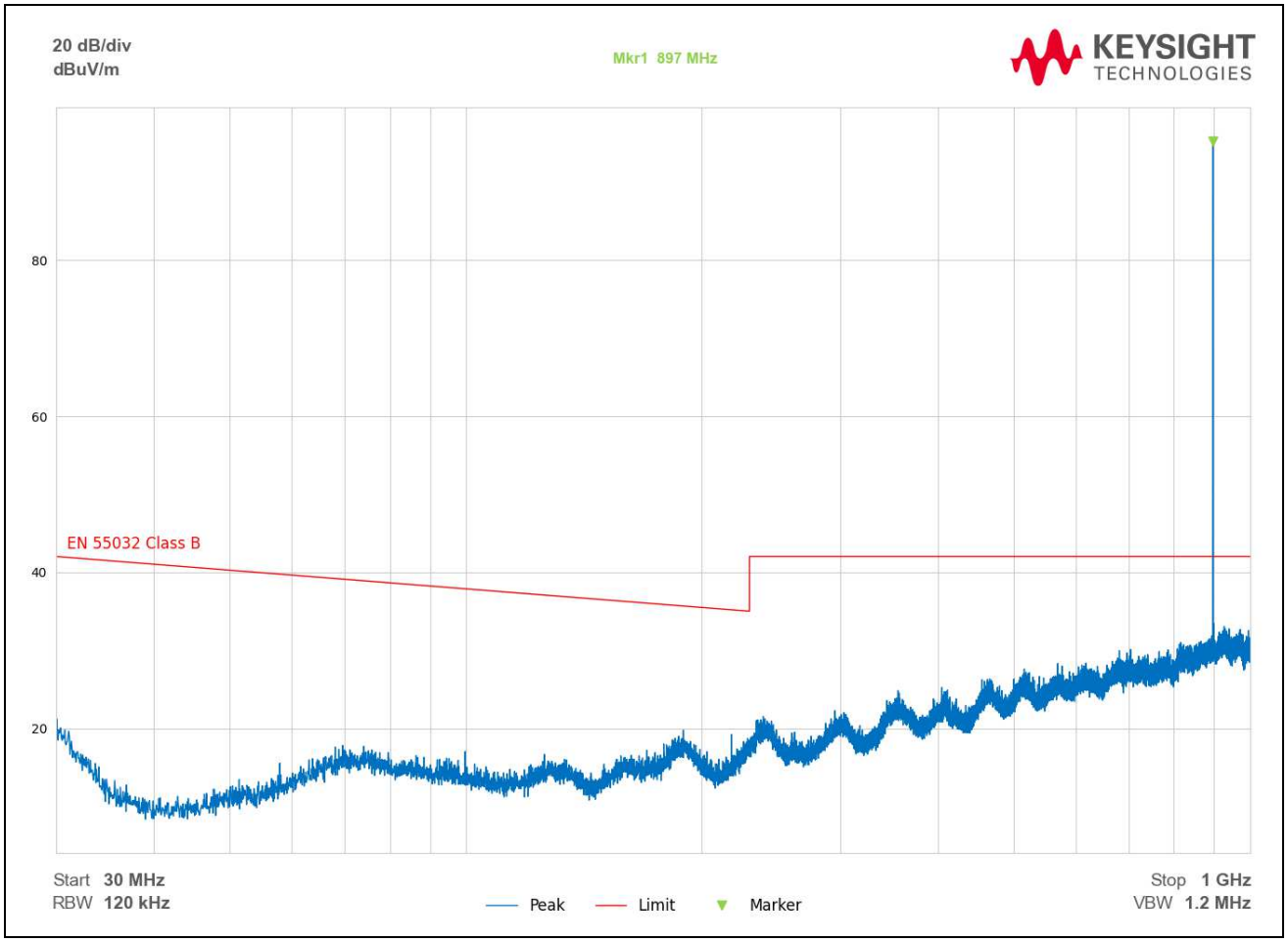
Graph 13: Radiated emissions results

Note: The 897MHz (NB-IoT) peak that exceed the limit line is the uplink of the device and should be ignored.

7.1.23 Radiated Emission: 30MHz – 1000MHz

Graph 14: Represents radiated emissions measured from the EUT in the vertical polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active Cellular (NB-IoT) and GPS



Graph 14: Radiated emissions results

Note: The 897MHz (NB-IoT) peak that exceed the limit line is the uplink of the device and should be ignored.

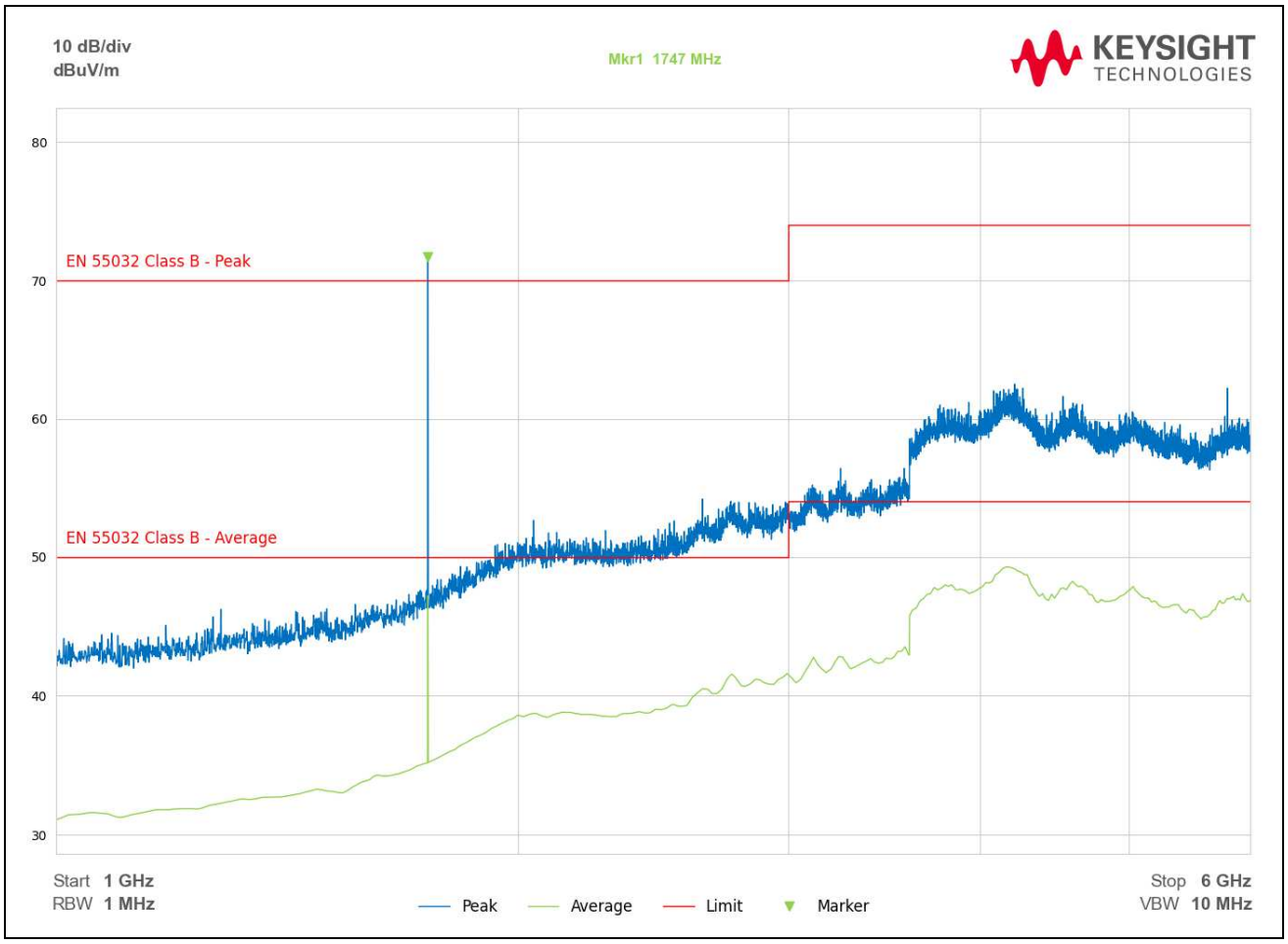
7.1.24 Conclusion

- The EUT complies with the radiated emissions requirements of EN 55032 / CISPR 32 for Class B devices.

7.1.25 Radiated Emission: 1000MHz – 6000MHz

Graph 15: Represents peak and average radiated emissions measured from the EUT in the Horizontal polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active Cellular (NB-IoT) and GPS



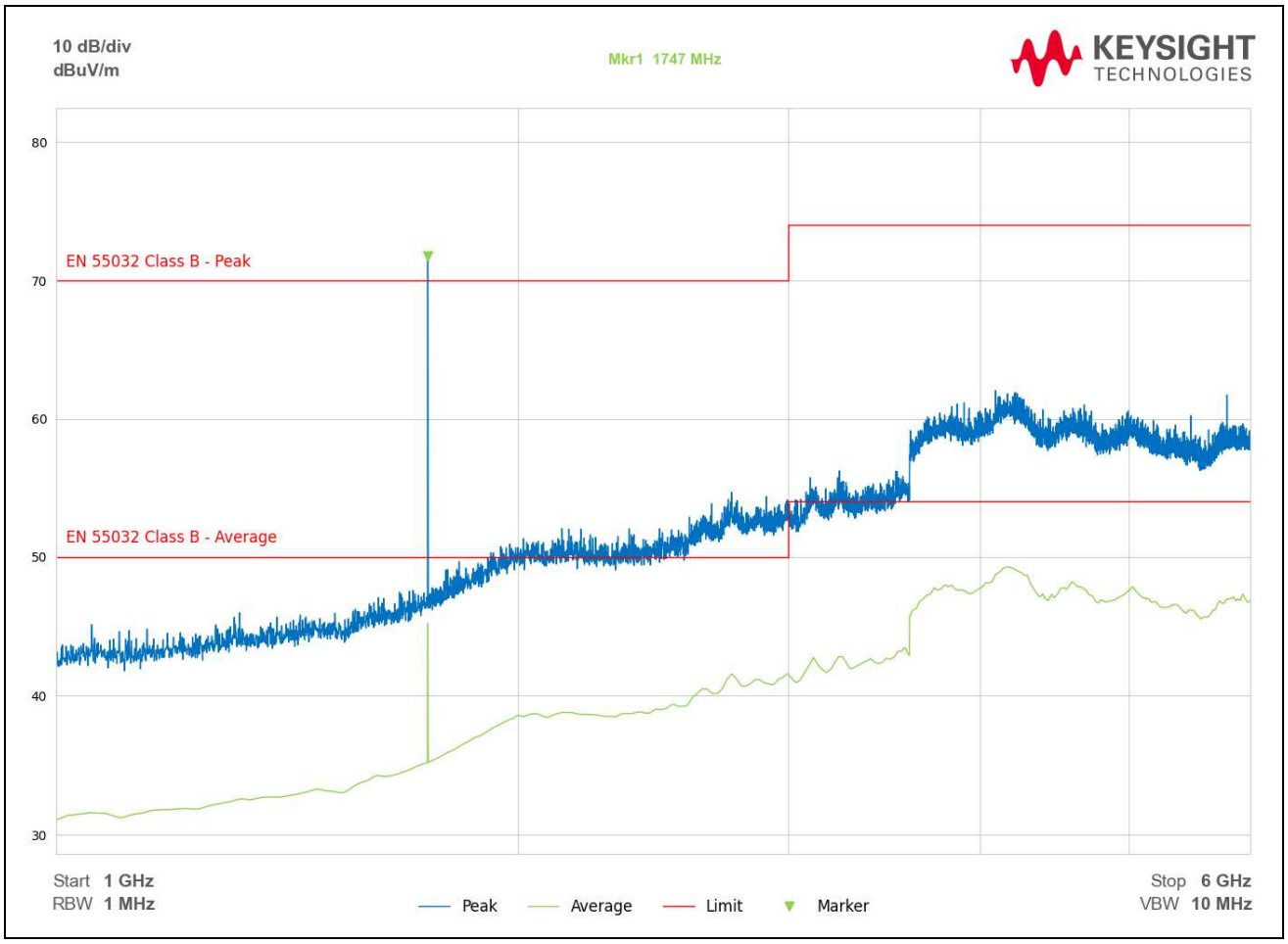
Graph 15: Radiated emissions results

Note: The 1.75GHz (NB-IoT) peak that exceed the limit line is the uplink of the device and should be ignored.

7.1.26 Radiated Emission: 1000MHz – 6000MHz

Graph 16: Represents peak and average radiated emissions measured from the EUT in the vertical polarization.

Power supply: 3.7Vdc Internal battery
Test Condition: Active Cellular (NB-IoT) and GPS



Graph 16: Radiated emissions results

Note: The 1.75GHz (NB-IoT) peak that exceed the limit line is the uplink of the device and should be ignored.

7.1.27 Conclusion

- The EUT complies with the radiated emissions requirements of EN 55032 / CISPR 32 for Class B devices.

8. IMMUNITY

8.1 EN / IEC 61000-4-2: ESD IMMUNITY

Method: The test is intended to demonstrate the immunity of equipment subjected to static electricity discharges from operators directly and to adjacent objects. The tabletop equipment under test is placed on a wooden table, 0.8 m high, standing on the ground reference plane. A horizontal coupling plane (HCP), 1.6 x 0.8 m, is placed on the table. The EUT and the cables are isolated from the coupling plane by an insulating support 0.5 mm thick. The floor standing equipment is isolated from the ground reference plane by an insulating support about 0.1 m thick. The vertical coupling plane (VCP) of dimensions 0.5 m x 0.5 m is placed parallel to, and positioned at 0.1 from, the EUT.

8.1.1 Set-up

a. The EUT was tested within its intended operating conditions as specified by the manufacturer.
b. The EUT was tested as tabletop equipment.
c. Electrostatic discharges are applied only to those points and surfaces of the EUT that will be accessible to users during normal operation.
d. The highlighted area (Figure. 9) will be sealed with a cap.
e. The time interval between two successive single discharges was at least 1 second.

8.1.2 ESD Test points

Figure 6: Top view

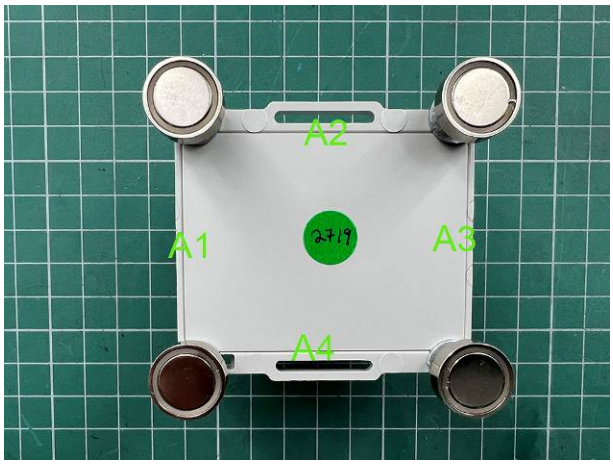


Figure 7: Bottom view

Figure 8: Left view

Figure 9: Right view

8.1.3 Results

Discharge Point	Contact discharge voltage	Discharges	Result	Criteria
HCP	± 4kV	10	Pass (1)	A
VCP	± 4kV	10	Pass (1)	A
C1 – C4	± 4kV	10	Pass (1)	A
C5 – C7	± 4kV	10	Pass (1)	A
C8 & C9	± 4kV	10	Pass (1)	A
Discharge Point	**Air discharge voltage**	**Discharges**	**Result**	**Criteria**
A1 – A4	± 8kV	10	Pass (1)	A
Note 1: The EUT was unaffected by the applied ESD pulses.				

8.1.4 Performance criteria

A: No loss of performance or function
B: Temporary loss of function or performance which is self-recoverable
C: Temporary loss of function or performance which requires operator intervention or system reset

8.1.5 Conclusion

- The EUT complies with the Electrostatic Immunity requirements of the standard.

8.2 EN / IEC 61000-4-3: RADIATED IMMUNITY

Method: The test allows estimating of the radiated immunity of electrical and electronic equipment to electromagnetic disturbances coming from intended radiofrequency (RF) transmitters in the frequency range 80MHz to 6000MHz. The interference is applied on the enclosure of the equipment by using transmitting antennas that was placed 3m from the front of the EUT and support system.

8.2.1 Set-up

a. The EUT was tested within its intended operating conditions as specified by the manufacturer.
b. The signal source was stepped through the applicable frequency range at a rate of 1% of the fundamental. The dwell time was set to 1 second.
c. The EUT was placed in the center of a non-metallic turntable.
d. The distance between the antenna and equipment was set to 3 meters.
e. The 1kHz sine wave was amplitude modulated to a depth of 80% over the entire frequency band.

8.2.2 Results

Polarization	Frequency (MHz)	EUT Position	Level (V/m)	Result	Criterion
Horizontal	80 – 1000	All Sides	3	Pass (1)	A
Vertical	80 – 1000	All Sides	3	Pass (1)	A
Note 1: The EUT was unaffected by the applied RF between 80 – 1000MHz					

Polarization	Frequency (GHz)	EUT Position	Level (V/m)	Result	Criterion
Horizontal	1 - 6	All Sides	3	Pass (2)	A
Vertical	1 - 6	All Sides	3	Pass (2)	A
Note 2: The EUT was unaffected by the applied RF between 1 – 6GHz					

8.2.3 Performance criterion

A: No loss of performance or function
B: Temporary loss of function or performance which is self-recoverable
C: Temporary loss of function or performance which requires operator intervention or system reset

8.2.4 Conclusion

- The EUT complies with the Radiated Immunity requirements of the standard.

8.2.5 GPS Immunity Test Set-up

a. The signal source was applied at 11 spot frequencies.
b. The 1kHz sine wave was amplitude modulated to a depth of 80% up to 715MHz.
c. A 200Hz sine wave was amplitude modulated to 100% for 920MHz.
d. The EUT was closely monitored for signs of susceptibility during testing.

8.2.6 Results

EUT Position	Frequency (MHz)	Polarization	Level (V/m)	Result	Criterion
Front	80, 104, 136, 165, 200, 260, 330, 430, 560, 715	H	3	Pass (1)	A
		V	3	Pass (1)	A
Left	80, 104, 136, 165, 200, 260, 330, 430, 560, 715	H	3	Pass (1)	A
		V	3	Pass (1)	A
Right	80, 104, 136, 165, 200, 260, 330, 430, 560, 715	H	3	Pass (1)	A
		V	3	Pass (1)	A
Rear	80, 104, 136, 165, 200, 260, 330, 430, 560, 715	H	3	Pass (1)	A
		V	3	Pass (1)	A
Note 1: The EUT was unaffected by the applied RF on the above spot frequencies.					

EUT Position	Frequency (MHz)	Polarization	Level (V/m)	Result	Criterion
Front	920	H	3	Pass (2)	A
		V	3	Pass (2)	A
Left	920	H	3	Pass (2)	A
		V	3	Pass (2)	A
Right	920	H	3	Pass (2)	A
		V	3	Pass (2)	A
Rear	920	H	3	Pass (2)	A
		V	3	Pass (2)	A
Note 2: The EUT was unaffected by the applied RF on the above frequency					

8.2.7 Performance criterion

A: No loss of performance or function
B: Temporary loss of function or performance which is self-recoverable
C: Temporary loss of function or performance which requires operator intervention or system reset

8.2.8 Conclusion

- The EUT complies with the Radiated Immunity requirements of the standard.

9. APPENDIX A: Normative References

1. ETSI EN 301 489-1 V2.2.3 (2019-11) ‘Electromagnetic compatibility and Radio Spectrum Matters (ERM)

2. ETSI EN 301 489-3 V2.3.2 (2023-01) 'Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz.'

3. ETSI EN 301 489-19 V2.1.1 (2019-04).'Specific conditions for Receive Only Mobile Earth Stations (ROMES) operating in the 1,5GHz band providing data communications and GNSS receivers operating in the RNSS band (ROGNESS) providing positioning, navigation, and timing data’.

4. ETSI EN 301 489-52 V1.1.0 (2021-11) 'Specific conditions for Cellular Communications Mobile and portable (UE) radio and ancillary equipment.

5. EN 55032 (2015 +A11:2020) / CISPR 32 (2015+A1:2019): ‘Electromagnetic compatibility of multimedia equipment – Emissions requirements

6. EN 61000-4-2 (2009) / IEC 61000-4-2 (2012): Testing and measurement techniques – Electrostatic discharge immunity test

7. EN 61000-4-3 (2006+A2:2010) / IEC 61000-4-3 (2006+A1:2007+A2:2010): Testing and measurement techniques –Radiated, radiofrequency, electromagnetic field immunity test.

10. APPENDIX B: Test Images

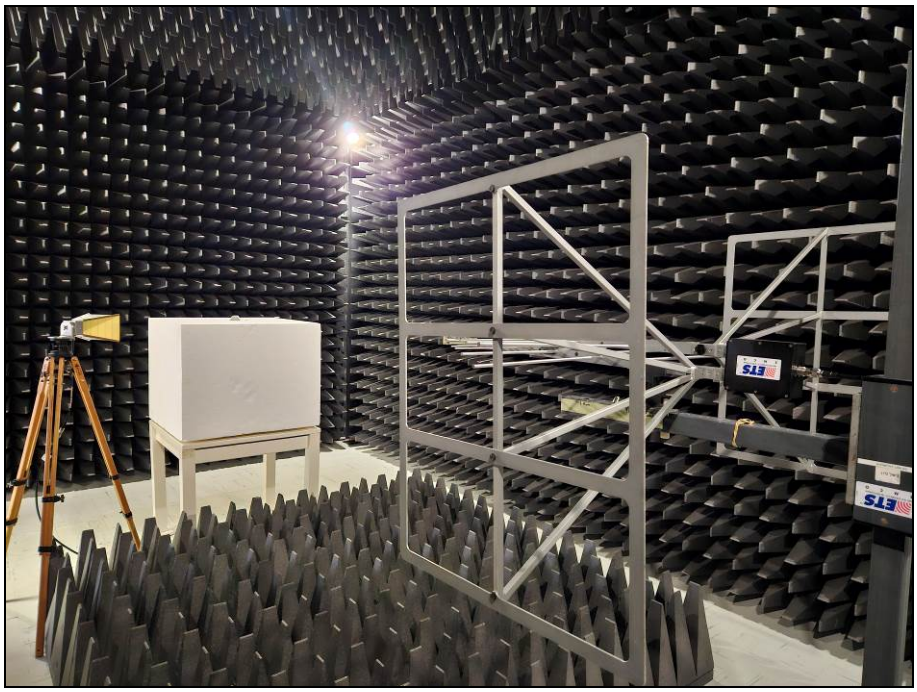


Figure 10: Radiated Emissions (30 – 1000MHz)

Figure 11: Radiated Emissions (1 – 6GHz)

Figure 12: Electrostatic Discharge Immunity

*** END OF REPORT ***