TEST REPORT

Test Report No. : UL-RPT-RP12712934-316A V2.0

Manufacturer	:	EC Solution Group B.V
Model No.	:	Versa 1
FCC ID	:	2ASXO-VERSA1
Technology	:	*Bluetooth* Low Energy, GSM 850 & PCS1900
Test Standard(s)	:	FCC Parts 15.209(a), 15.247(d), 2.1053, 22.917 & 24.238

1. This test report shall not be reproduced except in full, without the written approval of UL International (UK) Ltd.
2. The results in this report apply only to the sample(s) tested.
3. This sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.

Date of Issue: 27 October 2020

Checked by:

Ben Mercer
Lead Project Engineer, Radio Laboratory

Company Signatory:

Ian Watch
Senior Test Engineer, Radio Laboratory

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This laboratory is accredited by UKAS. The tests reported herein have been performed in accordance with its' terms of accreditation.

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Customer Information

Company Name:	EC Solution Group B.V
Address:	Van Boetzelaerlaan 40, Den Haag, 2581 AK, The Netherlands

Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	06/05/2020	Initial Version	Ben Mercer
2.0	27/10/2020	Tests repeated with increased Bluetooth power level, antenna gain updated.	Ben Mercer

Table of Contents

1. Attestation of Test Results

1.1. Description of EUT

The equipment under test was a luggage tracker device incorporating *Bluetooth* Low Energy & 2.4 GHz WLAN. The EUT also contains a cellular module with FCC ID:RI7UE910GL.

1.2. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.209
Specification Reference:	47CFR22
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 22 Subpart H (Cellular Radiotelephone Service)
Specification Reference:	47CFR24
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 24 Subpart E (Broadband Personal Communication Services)
Site Registration:	621311
Location of Testing:	Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Date:	15 October 2020 to 19 October 2020

1.3. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Transmit Mode; GSM 850 & *Bluetooth* LE		
Parts 15.209(a), 15.247(d), 2.1053 & 22.917	Transmitter Out of Band Radiated Emissions	✓
Transmit Mode; PCS 1900 & *Bluetooth* LE		
Parts 15.209(a), 15.247(d), 2.1053 & 24.238	Transmitter Out of Band Radiated Emissions	✓
Key to Results ✓ = Complied ✗ = Did not comply		

1.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

2. Summary of Testing

2.1. Facilities and Accreditation

The test site and measurement facilities used to collect data are located at Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom. The following table identifies which facilities were utilised for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

Site 1	
Site 17	X

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2.2. Methods and Procedures

Reference:	ANSI C63.26-2015
Title:	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	FCC KDB 971168 D01 v03r01, April 9, 2018
Title:	Measurement Guidance for Certification of Licensed Digital Transmitters
Reference:	KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019
Title:	Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules

2.3. Calibration and Uncertainty

Measuring Instrument Calibration

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value measured (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±3.30 dB
Radiated Spurious Emissions	1 GHz to 25 GHz	95%	±2.94 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

2.4. Test and Measurement Equipment

Test Equipment Used for Transmitter Radiated Emissions

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	06 Jan 2021	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	01 Nov 2020	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	20 Jan 2021	12
A3167	Pre-Amplifier	Com-Power	PAM-103	18020010	01 Nov 2020	12
A2863	Pre-Amplifier	Agilent	8449B	3008A02100	01 Nov 2020	12
A2896	Pre-Amplifier	Schwarzbeck	BBV 9721	9721-023	13 Feb 2021	12
A3161	Antenna	Teseq	CBL6111D	50859	07 Jan 2021	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	01 Nov 2020	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	01 Nov 2020	12
A2895	Antenna	Schwarzbeck	BBHA 9170	9170-728	13 Feb 2021	12
A3036	Low Pass Filter	AtlanTecRF	AFL-02000	15062902848	05 Feb 2021	12
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	06 Feb 2021	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	1601900001	06 Feb 2021	12
A1550	Notch Filter	Wainright Instruments GMBH	WRCT836.6-0.3/40-8EE	2	07 Jan 2021	12
A2926	Attenuator	AtlanTecRF	AN18W5-30	85850#2	06 Feb 2021	12
A2943	Attenuator	AtlanTecRF	AN18W5-06	208147#2	06 Feb 2021	12

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Versa
Model Name or Number:	Versa 1
Serial Number:	GEP903157
Hardware Version Number:	1.8.0
Software Version Number:	V1.0.0
FCC ID:	2ASXO-VERSA1

3.2. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.3. Additional Information Related to Testing

Technology Tested:	*Bluetooth* Low Energy (Digital Transmission System)		
Type of Unit:	Transceiver		
Channel Spacing:	2 MHz		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Top	39	2480

Type of Radio Device:	Transceiver		
Technology Tested:	GSM 850		
Transmit Frequency Range:	824 MHz to 849 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Middle	190	836.6
Technology Tested:	PCS 1900		
Transmit Frequency Range:	1850 MHz to 1910 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Middle	660	1879.8

3.4. Description of Available Antenna

The radio utilizes an integrated antenna, with the following maximum gain:

Frequency Range (MHz)	Antenna Gain (dBi)
824-849	0
1850-1910	0.7
2400-2480	1.5

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Test Laptop
Brand Name:	Dell Latitude
Model Name or Number:	E6320
Serial Number:	W922JA00

Description:	USB Type A to Micro USB Type B Cable. Quantity 1. Length 1.8m.
Brand Name:	Not stated or marked
Model Name or Number:	Not stated or marked
Serial Number:	Not stated or marked

Description:	AC to DC USB Charger
Brand Name:	Unifive
Model Name or Number:	UBK310-0520
Serial Number:	F07-300092

Description:	USB Diagnostic Cable and Test Jig
Brand Name:	Not stated or marked
Model Name or Number:	Not stated or marked
Serial Number:	Not stated or marked

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- Transmitting simultaneously with GSM 850 & *Bluetooth* LE at maximum power.
- Transmitting simultaneously with PCS 1900 & *Bluetooth* LE at maximum power.

4.2. Configuration and Peripherals

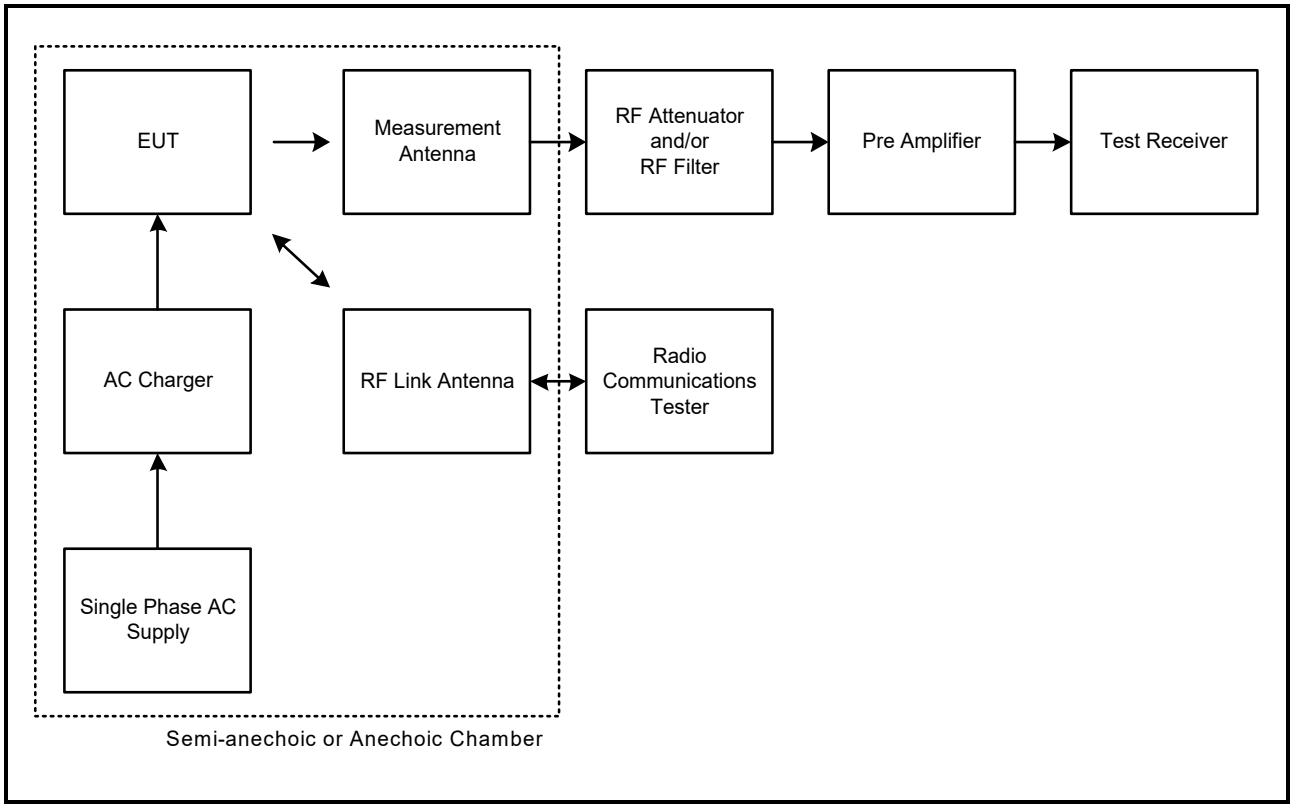
The EUT was tested in the following configuration(s):

- Measurements were performed with the EUT in the worst case orientation/position whilst powered via an AC to DC adapter, connected to 120 VAC 60 Hz.
- Cellular and *Bluetooth* LE co-location tests. The EUT was configured to simultaneously transmit with the following two permutations:
- GSM 850 and *Bluetooth* LE co-location, with the EUT configured to simultaneously transmit two signals at maximum output power (GSM 850 GPRS one timeslot in the uplink on middle channel 190 / 836.6 MHz and Bluetooth LE on top channel 39 / 2480 MHz).
- PCS 1900 and *Bluetooth* LE co-location, with the EUT configured to simultaneously transmit two signals at maximum output power (PCS 1900 GPRS one timeslot in the uplink on middle channel 660 / 1879.8 MHz, and Bluetooth LE on top channel 39 / 2480 MHz).
- The cellular link was controlled using a Rohde & Schwarz CMW500 GSM / UMTS / LTE system simulator.
- *Bluetooth* LE modes were controlled in test mode using a set of commands entered into a terminal application on the laptop PC supplied by the customer. The commands were used to enable continuous transmission and to select the test channels as required. The customer supplied a document containing the setup instructions “ESP32_Certification_and_Test_Guide__EN.pdf”, dated 20 February 2019. Once in the correct mode for radiated spurious emissions the laptop PC was removed.
- There were no other active ports to terminate

4.3. Description of Test Setup

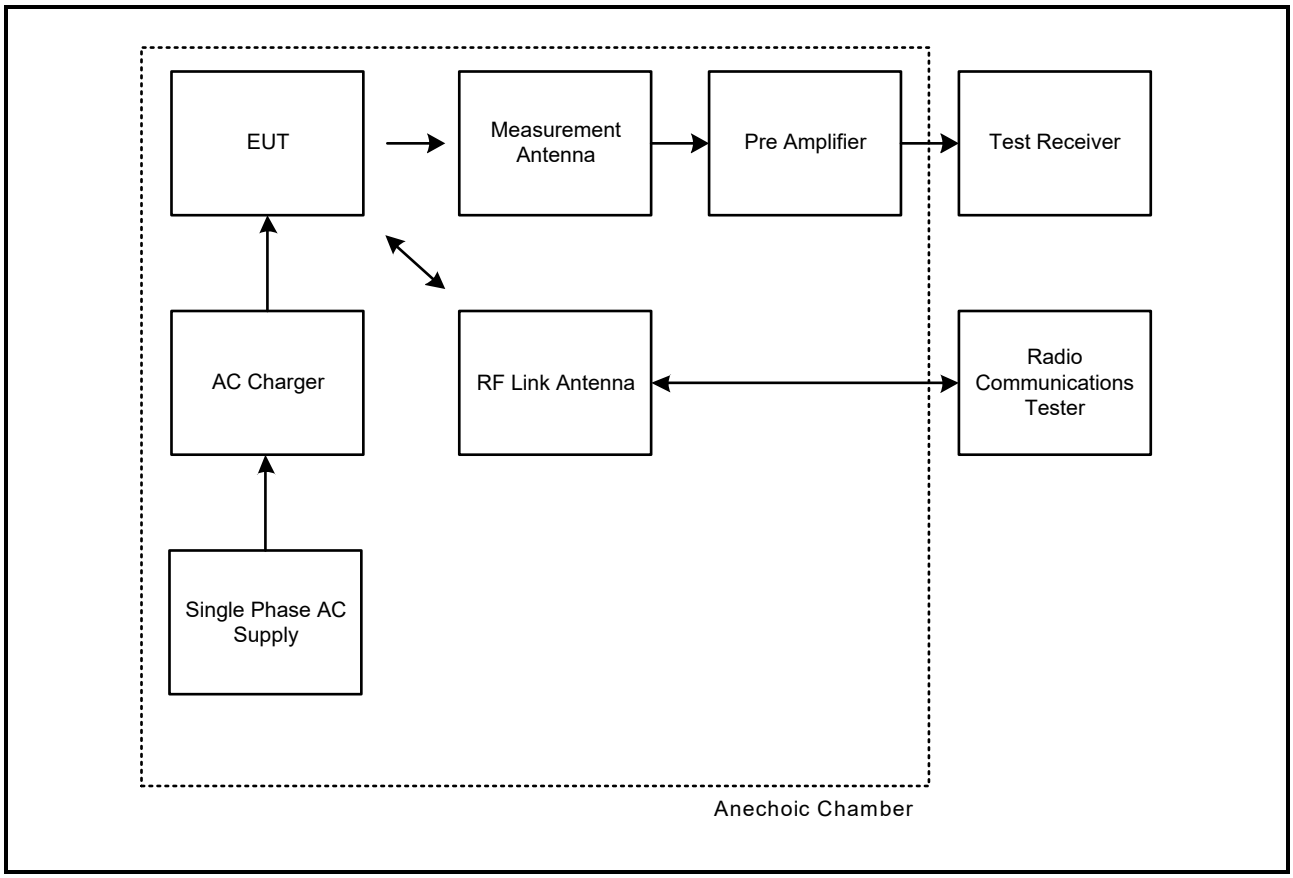
Test Setup for Transmitter Radiated Emissions

Measurements below 8 GHz

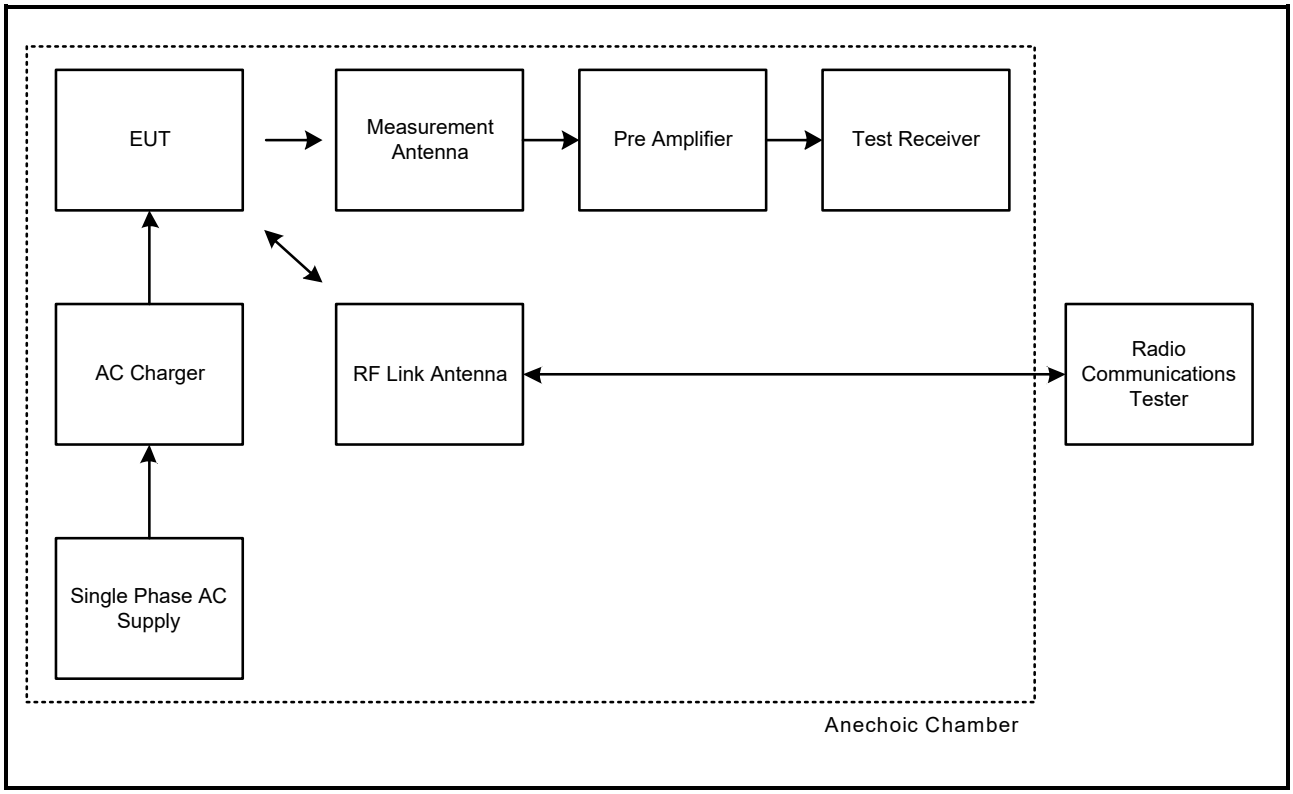


Test Setup for Transmitter Radiated Emissions (Continued)

Measurements 8 GHz – 18 GHz



Measurements above 18 GHz



4.4. Test Results

4.4.1.Transmitter Out of Band Radiated Emissions (GSM 850 & *Bluetooth* LE)

Test Summary:

Test Engineers:	Tom Sleigh & Jose Bayona	**Test Dates:**	15 October 2020 to 19 October 2020
Test Sample Serial Number:	GEP903157		

FCC Reference:	Parts 15.209(a), 15.247(d), 2.1053 & 22.917
Test Method Used:	FCC KDB 971168 Section 6.1 referencing ANSI C63.26 Section 5.2.7 FCC KDB 558074 Sections 8.1 c)3), 8.5 & 8.6 referencing ANSI C63.10 Sections 6.3, 6.6, 11.11 & 11.12
Frequency Range:	30 MHz to 25 GHz
Configuration:	GSM 850 GPRS / *Bluetooth* LE

Environmental Conditions:

Temperature (°C):	21 to 25
Relative Humidity (%):	35 to 41

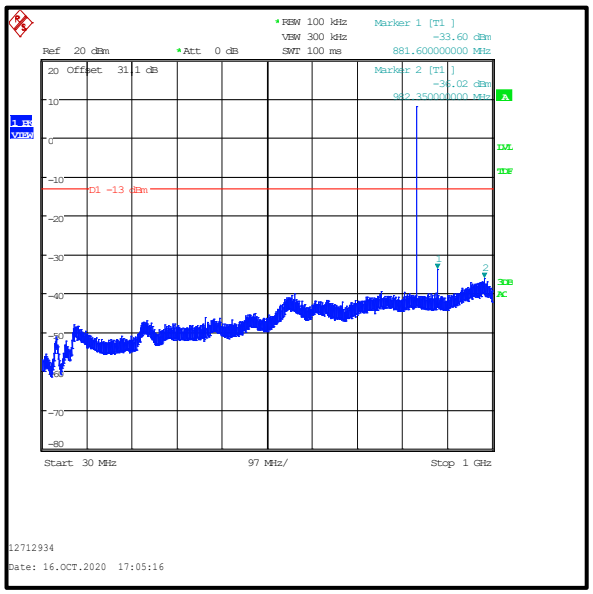
Results: GSM 850 - Middle Channel / Bluetooth LE - Top Channel

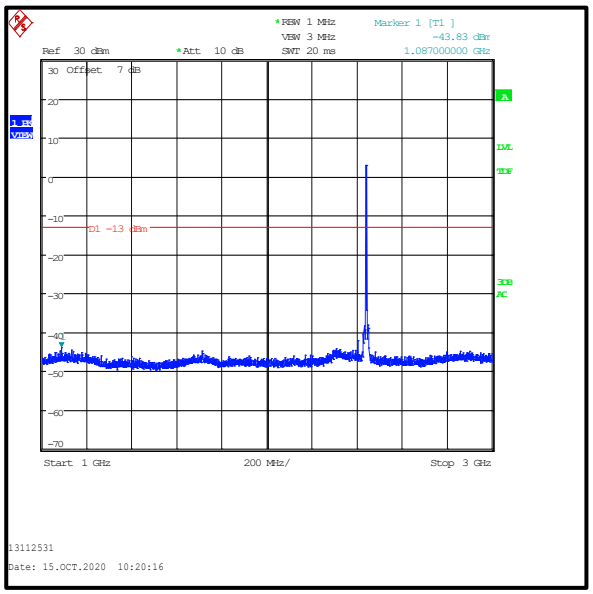
Emission Frequency (MHz)	Emission Level	Applicable Limit	Margin (dB)	Result
See Note 1				

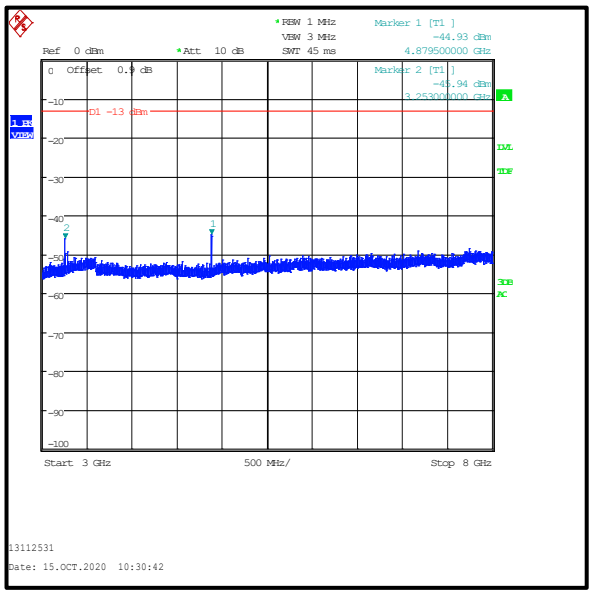
Note(s):

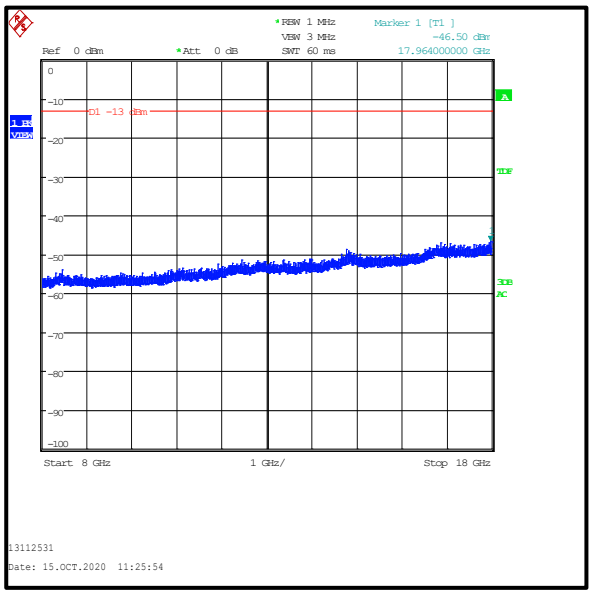
1. All intermodulation products were below the noise floor level or greater than 20 dB of the specification limit.
2. The emissions at approximately 836.6 MHz and 881.5MHz on the 30 MHz to 1 GHz plot are the GSM 850 uplink and downlink signals.
3. The emission at approximately 2480 MHz on the 1 to 3 GHz plot is the *Bluetooth* LE fundamental.
4. Pre-scans were made against the -13 dBm limit for radiated emissions as this is the least onerous of the spurious emissions limits for Part 15 & Part 22.
5. Pre-scans below 1 GHz were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. The sweep time was set to auto. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
6. Pre-scans above 1 GHz were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto. Peak and average measurements were performed with their respective detectors during the pre-scan measurements.

Transmitter Out of Band Radiated Emissions (GSM 850 & *Bluetooth* LE) continued

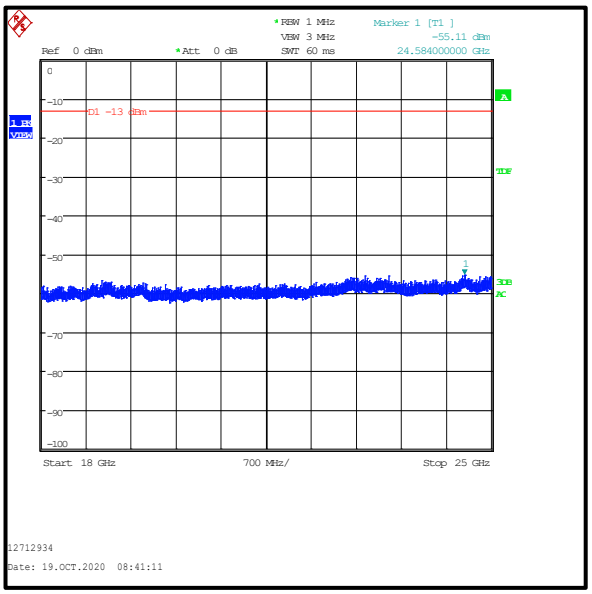








Transmitter Out of Band Radiated Emissions (GSM 850 & *Bluetooth* LE) continued



4.4.2.Transmitter Out of Band Radiated Emissions (PCS 1900 & *Bluetooth* LE)

Test Summary:

Test Engineers:	Tom Sleigh & Jose Bayona	**Test Dates:**	15 October 2020 to 19 October 2020
Test Sample Serial Number:	GEP903157		

FCC Reference:	Parts 15.209(a), 15.247(d), 2.1053 & 24.238
Test Method Used:	FCC KDB 971168 Section 6.1 referencing ANSI C63.26 Section 5.2.7 FCC KDB 558074 Sections 8.1 c)3), 8.5 & 8.6 referencing ANSI C63.10 Sections 6.3, 6.6, 11.11 & 11.12
Frequency Range:	30 MHz to 25 GHz
Configuration:	PCS 1900 GPRS / *Bluetooth* LE

Environmental Conditions:

Temperature (°C):	21 to 25
Relative Humidity (%):	35 to 41

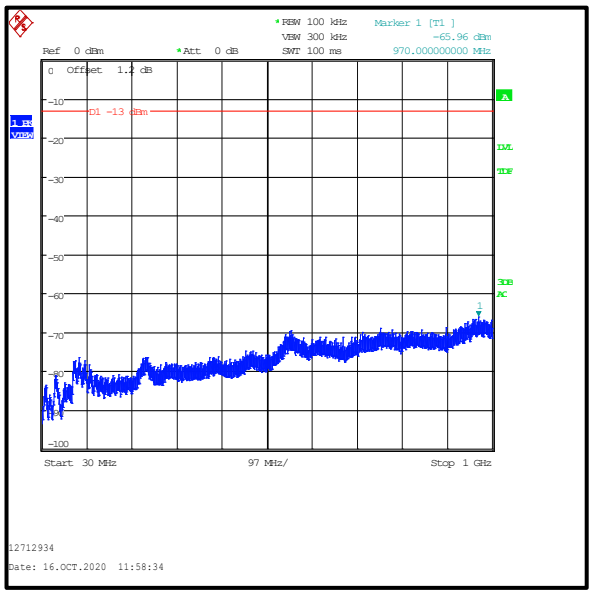
Results: PCS 1900 - Middle Channel / Bluetooth LE - Top Channel

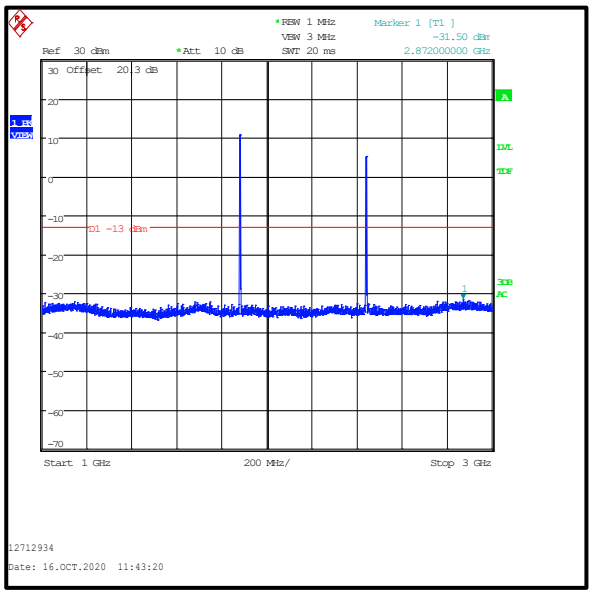
Emission Frequency (MHz)	Emission Level	Applicable Limit	Margin (dB)	Result
See Note 1				

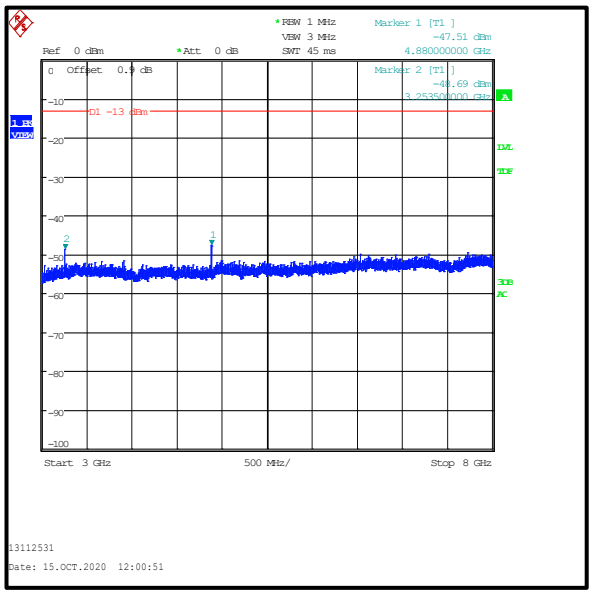
Note(s):

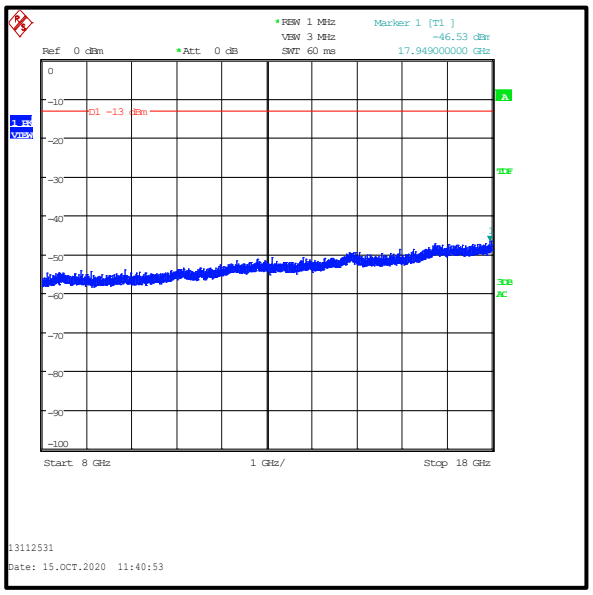
1. All intermodulation products were below the noise floor level or greater than 20 dB of the specification limit.
2. The emission at approximately 1879.8 MHz on the 1 to 3 GHz plot is the PCS 1900 uplink signal.
3. The emission at approximately 2480 MHz on the 1 to 3 GHz plot is the *Bluetooth* LE fundamental.
4. re-scans were made against the -13 dBm limit for radiated emissions as this is the least onerous of the spurious emissions limits for Part 15 & Part 24.
5. Pre-scans below 1 GHz were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. The sweep time was set to auto. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
6. Pre-scans above 1 GHz were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto. Peak and average measurements were performed with their respective detectors during the pre-scan measurements.

Transmitter Out of Band Radiated Emissions (PCS 1900 & *Bluetooth* LE) continued

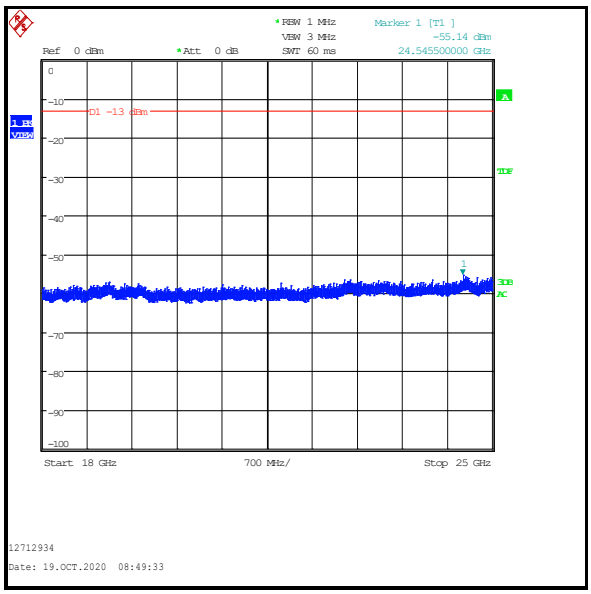








Transmitter Out of Band Radiated Emissions (PCS 1900 & *Bluetooth* LE) continued



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