DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España

DEKRA

ENAC ENSAYOS Nº 51/LE147

FCC LISTED, REGISTRATION NUMBER: 720267

ISED LISTED REGISTRATION NUMBER 4621A-2

Informe de ensayo nº:
Test report No:

NIE: 52641RRF.006

Partial test report

USA FCC Part 15.247, 15.209
CANADA RSS-247, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.
Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.
General Requirements and Information for the Certification of Radio Apparatus.

Identificación del objeto ensayado.....: Identification of item tested	Vibrating Wire sensor with EU and FCC radio
Marca .....: Trademark	Loadsensing G6
Modelo y/o referencia tipo .....: Model and /or type reference	LS-G6-VW-1M
Otra identificación del producto.....: Other identification of the product	FCC ID: 2AHN4-LS-G6-VW-1M IC: 21260-LSG6VW1M
Final HW version .....:	1M
Final SW version .....:	2.23
Características .....: Features	LoRa radio, Channel Hopping
Fabricante .....: Manufacturer	WORLDSENSING SL c/Viriat, 47, Edificio Numancia 1, 7th floor, 08014 Barcelona, SPAIN
Método de ensayo solicitado, norma.....: Test method requested, standard	USA FCC Part 15.247 10-1-17 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 10-1-17 Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 4 (November 2014). -FCC 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations radiated (Transmitter) Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v04 dated 05/04/2017. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Aprobado por (nombre / cargo y firma) .....: Approved by (name / position & signature)	A. Llamas RF Lab. Manager Firmado digitalmente por ALEJANDRO LLAMAS RODRIGUEZ Fecha: 2018.03.12 15:52:44 +01'00'
Fecha de realización .....: Date of issue	2018-03-12

Formato de informe No. .....: Report template No	FDT08_20

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DEKRA Testing and Certification is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjuction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 720267.

DEKRA Testing and Certification is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: ISED 4621A-2.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification has a calibration and maintenance program for its measurement equipment.

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Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification.internal document PODT000.

Usage of samples

Samples undergoing test have been selected by: **the client**

Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
52641/045	Vibrating Wire sensor	LS-G6-VW-1M	6	2017-09-12
52641/041	Antenna Type N	---	---	2017-06-06

1. Sample S/01 has undergone following test(s).

   All tests indicated in appendix A.

Test sample description

The test sample consist of a sensor which is capable of measure changes in pressure by using a vibrating wire.

Identification of the client

WORLDSENSING SL
c/Viriat, 47, Edificio Numancia 1, 7th floor, 08014 Barcelona, SPAIN.

Testing period

The performed test started on 2017-09-22 and finished on the same day.

The tests have been performed at DEKRA Testing and Certification.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

Remarks and comments

1: The tests have been performed by the technical personnel: Pedro Parada Luna and Carolina Postigo Martín.

2: Test not requested by the client.

3: Used instrumentation:

Radiated Measurements

		Last Cal. date	Cal. due date
1.	Semianechoic Absorber Lined Chamber ETS FACT3 200STP	N.A.	N.A.
2.	BiconicalLog antenna ETS LINDGREN 3142E	2015/06	2018/06
3.	Multi Device Controller EMCO 2090	N.A.	N.A.
4.	Double-ridge Guide Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2016/11	2019/11
5.	EMI Test Receiver R&S ESU 40	2016/03	2018/03
6.	Spectrum analyser Rohde & Schwarz FSW50	2015/12	2017/12
7.	RF pre-amplifier 20 MHz-7 GHz PAM-0207	2016/09	2017/09
8.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M	2016/02	2018/02

Testing verdicts

Not applicable ..... :	N/A
Pass ..... :	P
Fail ..... :	F
Not measured ..... :	N/M

FCC PART 15 PARAGRAPH / RSS-247		VERDICT			
		NA	**P**	**F**	**NM**
FCC 15.247 Subclause (a) (1) / RSS-247 Clause 5.1 (b)	20 dB Bandwidth and Carrier frequency separation				NM[2]
FCC 15.247 Subclause (a)(1)(iii) / RSS-247 Clause 5.1 (c)	Number of hopping channels	NA			
FCC 15.247 Subclause (f)/ RSS-247 Clause 5.3 (a)	Time of occupancy (Dwell Time)				NM[2]
FCC 15.247 Subclause (b) / RSS-247 Clause 5.4 (a)	Maximum peak output power and antenna gain				NM[2]
FCC 15.247 Subclause (d) / RSS-247 Clause 5.5	Emission limitations conducted (Transmitter)				NM[2]
FCC 15.247 Subclause (d) / RSS-247 Clause 5.5.	Band-edge emissions compliance (Transmitter)				NM[2]
FCC 15.247 Subclause (f) / RSS-247 5.3. (b)	Power spectral density				NM[2]
FCC 15.247 Subclause (d) / RSS-247 Clause 5.5	Emission limitations radiated (Transmitter)		P		

2: See section “Remarks and comments”.

Appendix A – Test result

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TEST CONDITIONS

Power supply (V):

$V_{nominal}$ = 3.7 Vdc

Type of power supply = DC voltage from internal battery.

Type of antenna = External attachable antenna.

TEST FREQUENCIES:

Lowest channel: 902.3 MHz

Middle channel: 908.7 MHz

Highest channel: 914.9 MHz

The equipment can operate as hybrid system using 8 hopping channels.

The sample was used to configure the EUT to transmit at a specified output power in all channels (Power Setting in DUT = 20).

RADIATED MEASUREMENTS

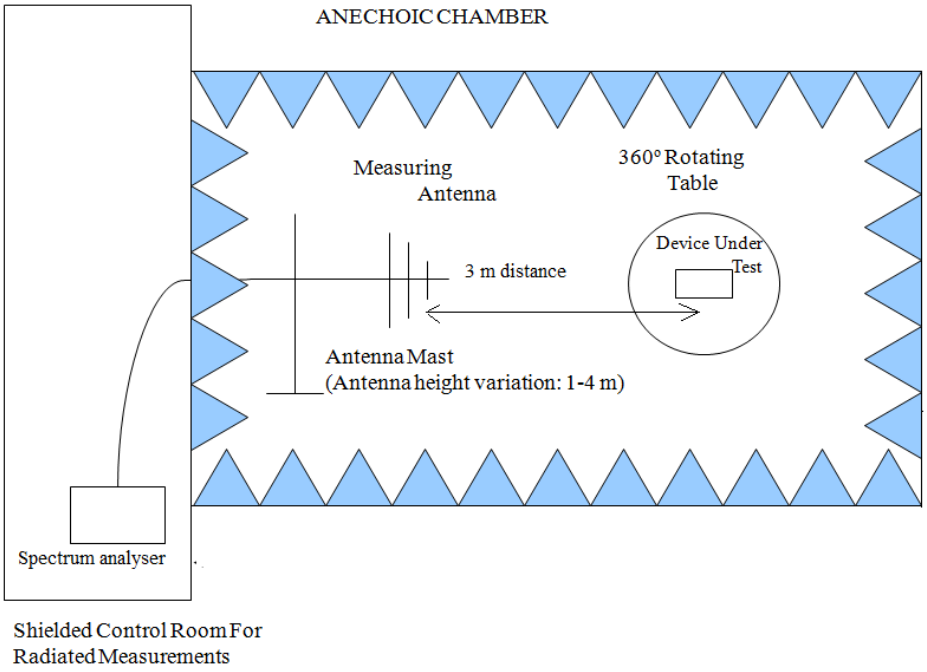
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-10 GHz (1 GHz-18 GHz Double ridge horn antenna).

For radiated emissions in the range 1 GHz-10 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

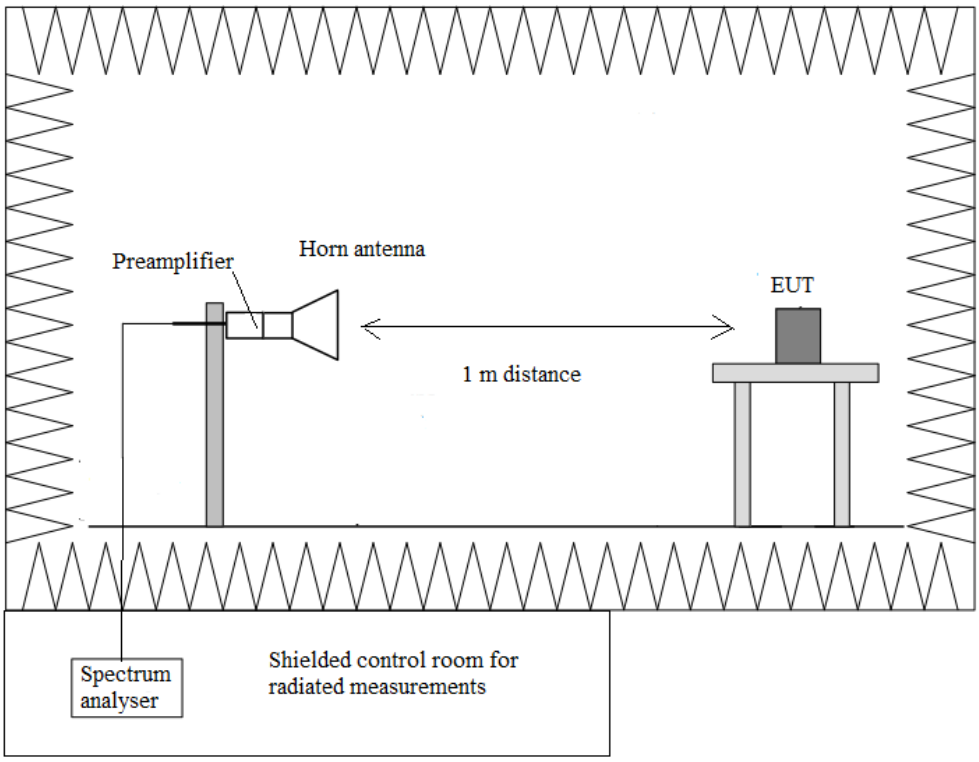
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

Radiated measurements setup f < 1 GHz



Radiated measurements setup f > 1 GHz



FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5 Emission limitations radiated (Transmitter)

SPECIFICATION

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)/RSS-Gen):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 10000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247. Attenuation below the general field strength limits specified in RSS-Gen is not required.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-10 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Frequency range 30 MHz-1000 MHz.

No spurious signals were found at less than 20 dB respect to the limit.

Frequency range 1 GHz-10 GHz

The results in the next tables show the maximum measured levels in the 1-10 GHz range (see next plots).

Spurious signals with peak levels above the average limit (54 dBµV/m at 3 m) are measured with average detector for checking compliance with the average limit.

1. CHANNEL: LOWEST (902.3 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
1.80445	H	Peak	37.24	± 4.87
2.70685	V	Peak	50.15	± 4.87
4.51165	H	Peak	42.28	± 4.87
5.41375	V	Peak	46.71	± 4.87
6.31585 (*)	H	Peak	67.12	± 4.87
		AVG	65.85	± 4.87
7.21795	H	Peak	54.20	± 4.87
		AVG	52.79	± 4.87
8.12095	V	Peak	46.28	± 4.87
9.92450	H	Peak	48.64	± 4.87

(*): This spurious frequency is outside the restricted bands as defined in §15.205(a). The measured maximum carrier level at 3 m was 117.44 dBµV/m (Peak) so the spurious level is more than 20 dB below the carrier level.

2. CHANNEL: MIDDLE (908.7 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
2.72605	V	Peak	49.67	± 4.87
4.54345	H	Peak	42.80	± 4.87
5.45215	H	Peak	46.80	± 4.87
6.36115 (*)	H	Peak	65.41	± 4.87
		AVG	65.10	± 4.87
7.27015	H	Peak	53.04	± 4.87
8.17795	H	Peak	47.71	± 4.87
9.08755	H	Peak	48.35	± 4.87

(*): This spurious frequency is outside the restricted bands as defined in §15.205(a). The measured maximum carrier level at 3 m was 116.15 dBµV/m (Peak) so the spurious level is more than 20 dB below the carrier level.

3. CHANNEL: HIGHEST (914.9 MHz).

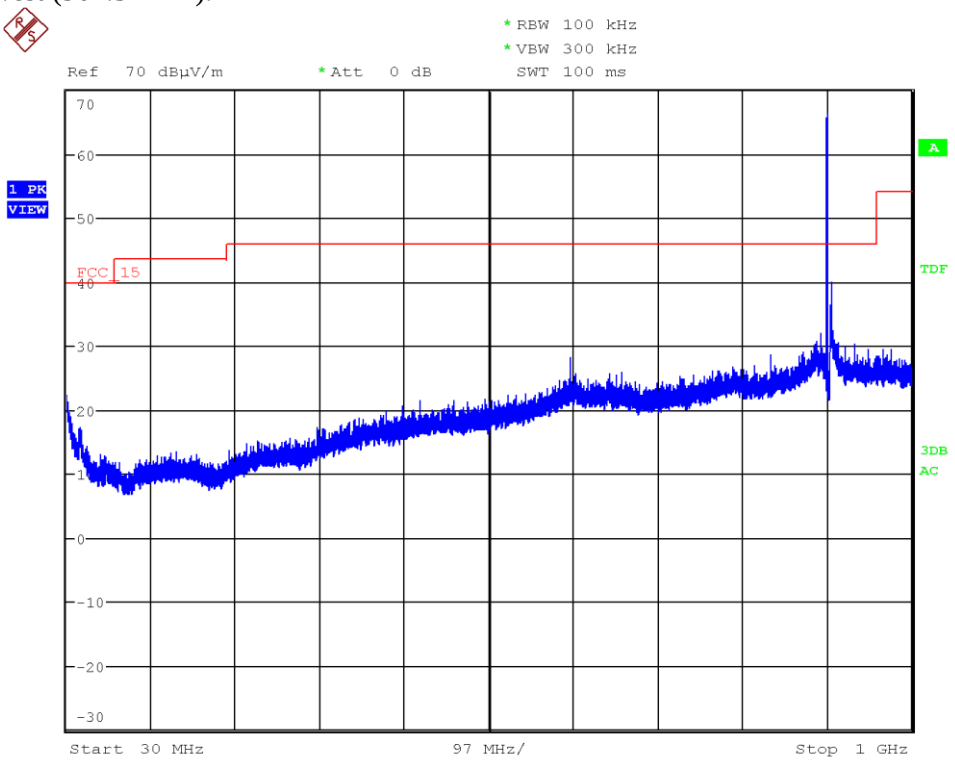
Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
2.74465	H	Peak	41.96	± 4.87
3.65965	H	Peak	38.84	± 4.87
4.57465	H	Peak	42.81	± 4.87
5.48905	H	Peak	46.64	± 4.87
6.40435 (*)	H	Peak	64.15	± 4.87
		AVG	63.82	± 4.87
7.31965	H	Peak	53.89	± 4.87
8.23435	H	Peak	48.52	± 4.87
9.14875	H	Peak	46.85	± 4.87

(*): This spurious frequency is outside the restricted bands as defined in §15.205(a). The measured maximum carrier level at 3 m was 118.15 dBµV/m (Peak) so the spurious level is more than 20 dB below the carrier level.

Verdict: PASS

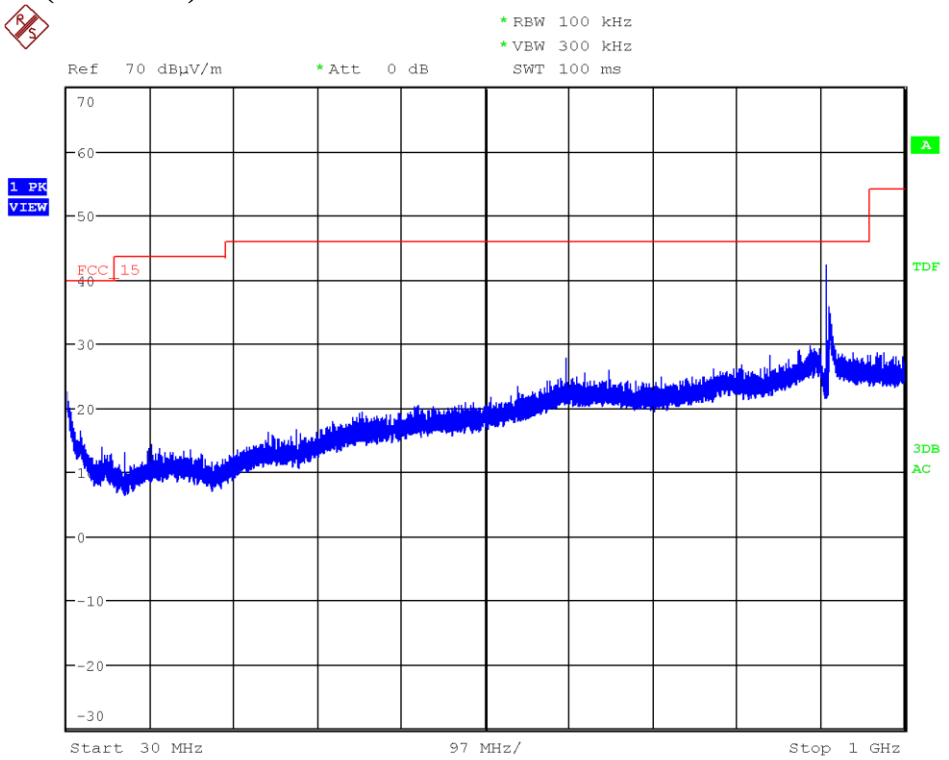
FREQUENCY RANGE 30 MHz-1000 MHz.

CHANNEL: Lowest (902.3 MHz).



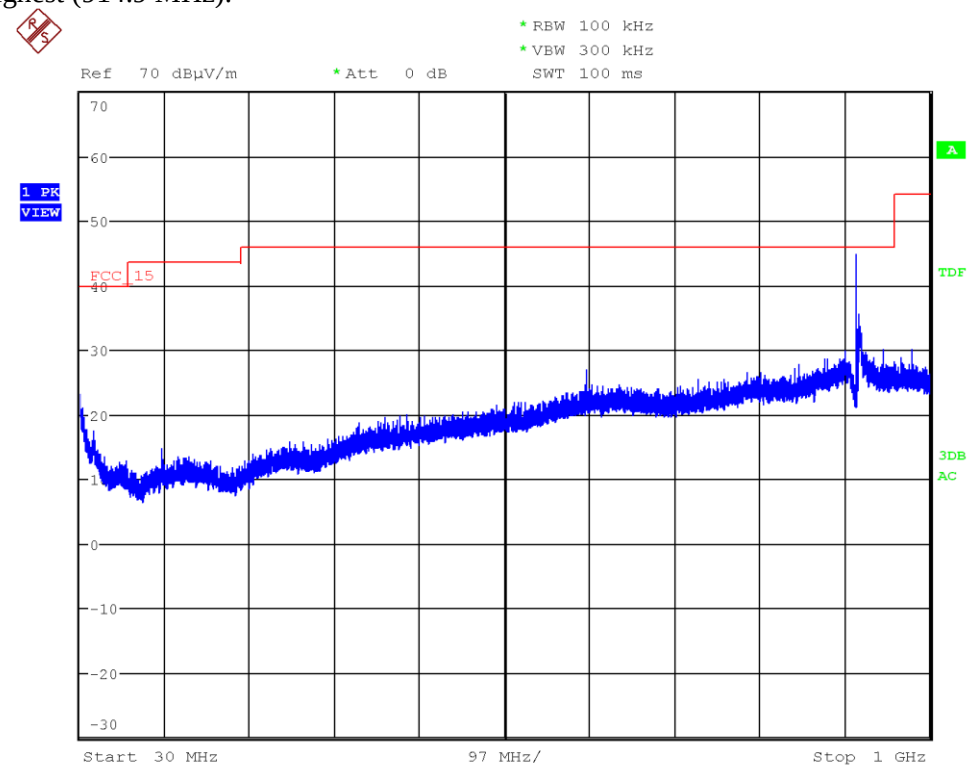
Note: The carrier was attenuated using a notch-filter. The peak above the limit is the carrier frequency.

CHANNEL: Middle (908.7 MHz).



Note: The carrier was attenuated using a notch-filter. The peak shown in the plot is the carrier frequency.

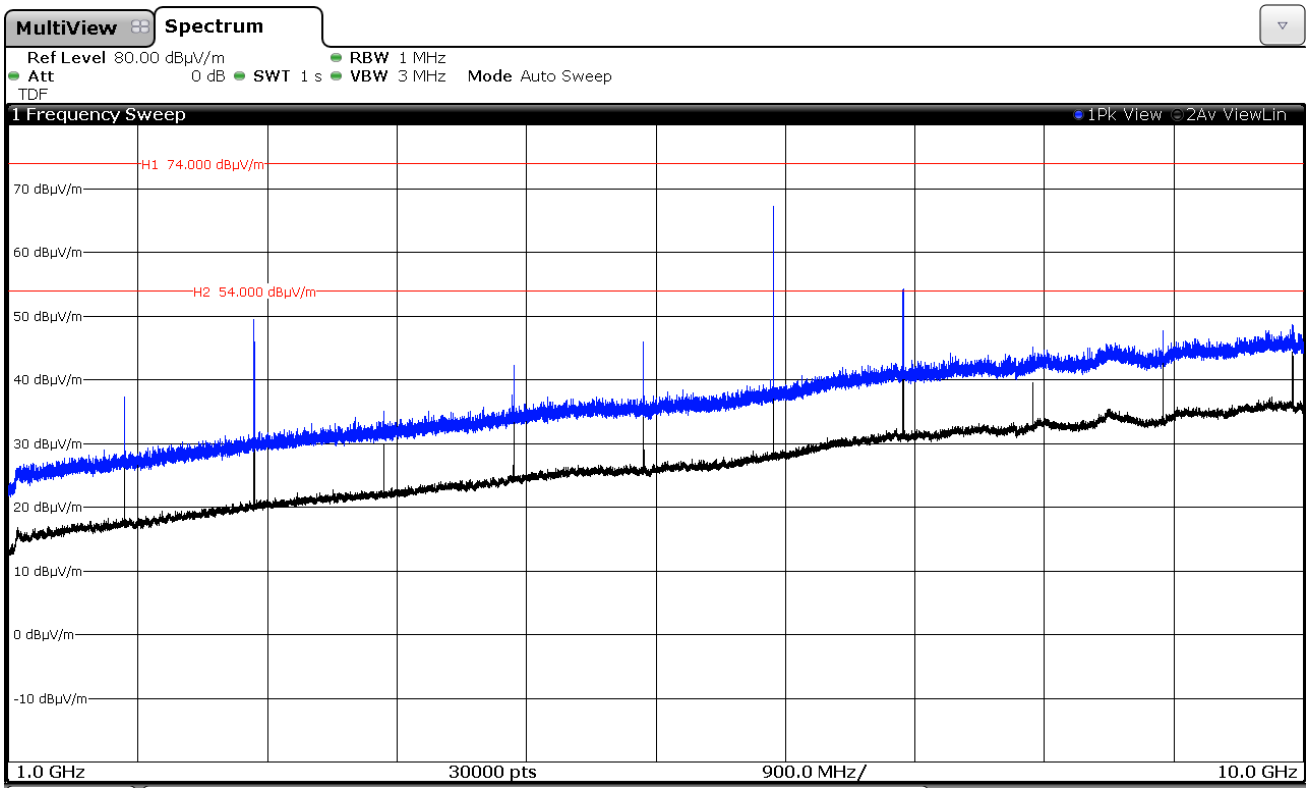
CHANNEL: Highest (914.9 MHz).



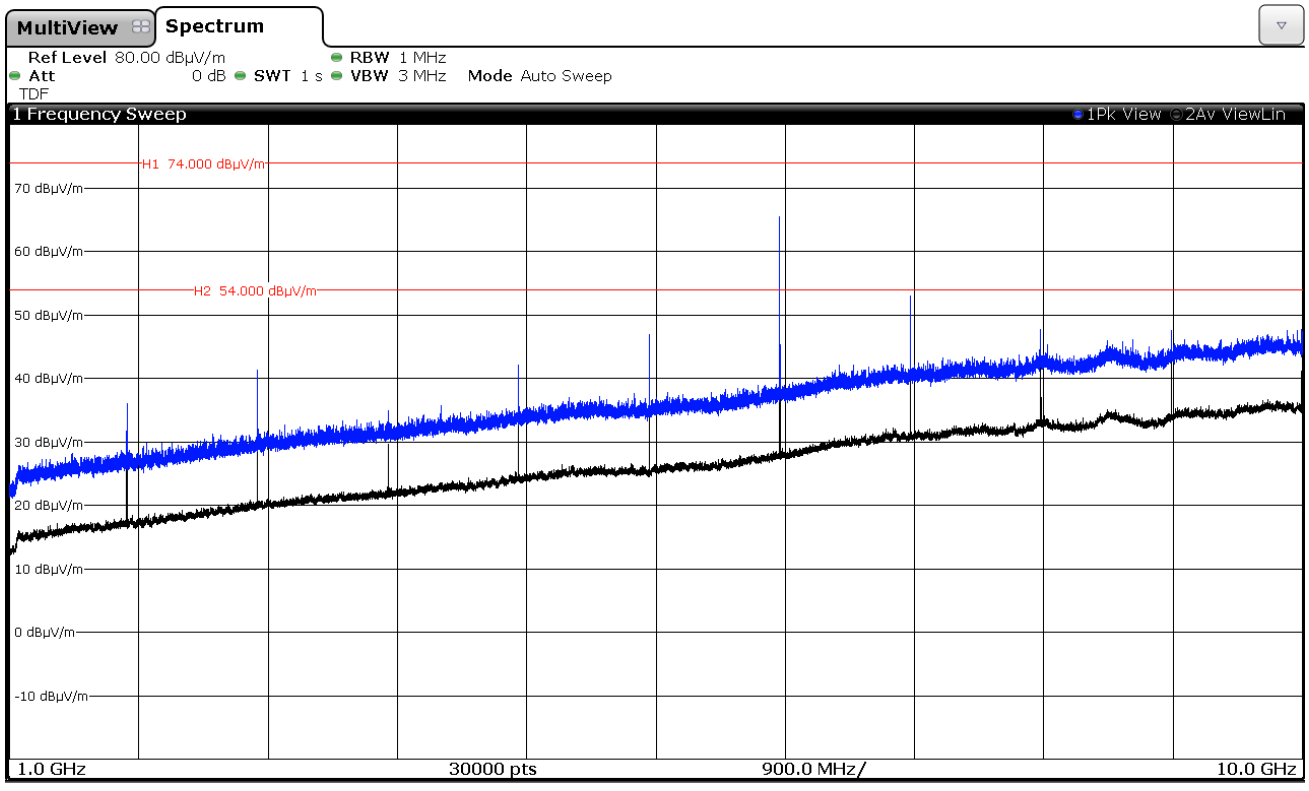
Note: The carrier was attenuated using a notch-filter. The peak shown in the plot is the carrier frequency.

FREQUENCY RANGE 1 GHz to 10 GHz.

CHANNEL: Lowest (902.3 MHz).



CHANNEL: Middle (908.7 MHz).



CHANNEL: Highest (914.9 MHz).