

Radio Test report – 386557TRFWL

Applicant:

Sensor ID Srl

Product:

UHF RFID reader

Model:

U04 ETH 11

FCC ID:

FCC ID: 2AVDNGC665017

Specifications:

♦ FCC 47 CFR Part 15 Subpart C, §15.247

Operation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz

Tested by (name, function and signature)	S.Tessa ,D. Guarnone	(project handler)	
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Date	2020-03-18		

Test location

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Toll free	+1 800 563 6336
Website	www.nemko.com
Site number	682159

Throughout this report point is used as decimal separator.

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko S.p.A.. ISO/IEC 17025 accreditation.

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Section 1. Report summary

Applicant and manufacturer

Company name	Sensor ID Srl
Address	Via G. Mucciardi, 5 – 86020 Campochiaro (CB) – Italy

Test specifications

FCC 47 CFR Part 15.247	Operation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz
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Test method

ANSI C63.10-2015	American National Standard of procedure for Compliance Testing of Unlicensed Wireless Devices
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Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.5 below. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

Exclusions

As per customer’s quotation, this report is for verification purpose of Class I permissive change; only output power and spurious emissions tests have been assessed, all other tests were excluded from the scope of this report.

Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued

Section 2. Summary of test results

FCC Part 15 Subpart C, §15.247, test results for FHSS

Part	Test description	Verdict
§15.31(m)	Number of frequencies to be investigated	Pass
§15.203	Antenna requirement	Pass
§15.247(a)(1)(i)	20 dB bandwidth	Pass
§15.247(a)(1)(i)	Carrier frequency separation	Pass
§15.247(a)(1)(i)	Number of hopping frequencies	Pass
§15.247(a)(1)(i)	Average time of occupancy	Pass
§15.247(b)(2)(4)	Maximum peak output power in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Pass
§15.247(d)	Spurious emissions in restricted and non restricted bands	Pass

Section 3. Equipment under test (EUT) details

Sample information

Receipt date	January 20, 2020
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EUT information

Product name	UHF RFID reader
Model	U04 ETH 11
Part number	--
Revision	--
Serial number	386557-1/3 (Number assigned by Nemko spa)
Operating band	902.75 MHz ÷ 927.25 MHz
Operating frequency	902.75 MHz ÷ 927.25 MHz
Modulation	FHSS
Channel bandwidth	80.92 kHz, @ 20 dB
Power requirements	9 ÷ 24 Vdc
Emission designator	80K9K1D
Antenna information	The EUT uses an integrated antenna

EUT (front)



Manufacturer of Software	Sensor ID
Software	Serial ID Reader Suite, version 1.2

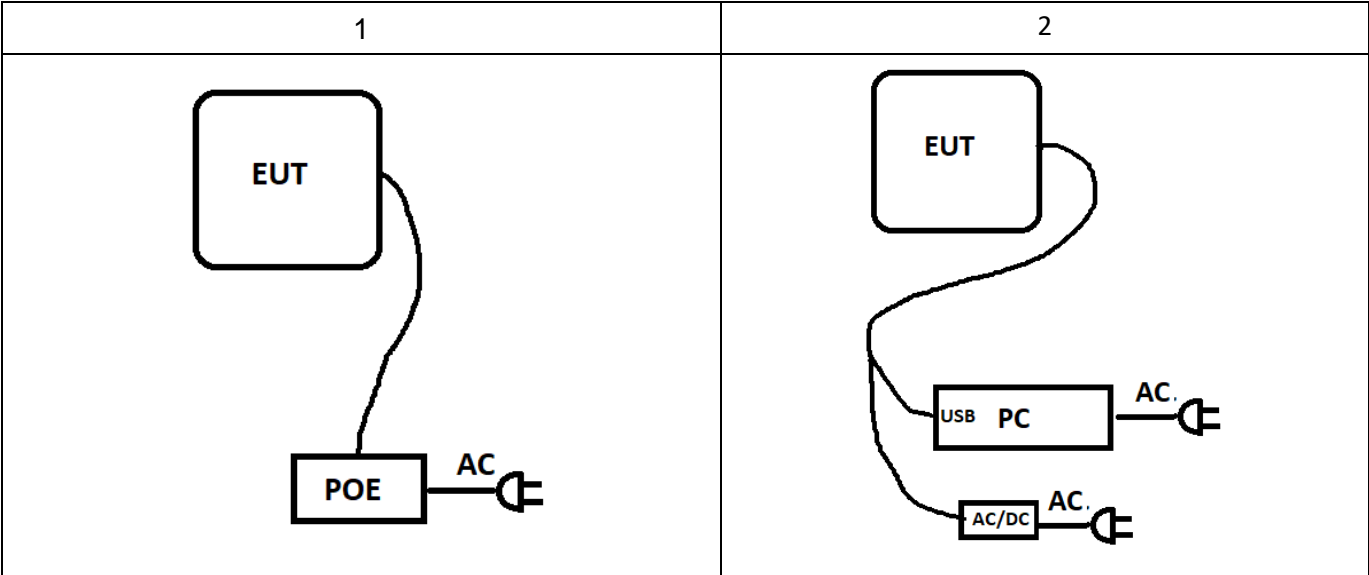
Product description and theory of operation

Discovery Gate UHF is a stand-alone high power solution that allows reading and writing of passive UHF tags up to a distance of 8m. It is ideal for hand-free access control applications, vehicular control and industrial applications. Thanks to the high radio frequency performance is able to detect passive tags when in contact with the body and in contact with liquid containers.

EUT exercise details

EUT was set up to transmit continuously, at full power. The EUT was controlled and channels selected using a proprietary test software provided by client.

EUT setup diagram



Section 4. Engineering considerations

Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

Technical judgment

None

Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

Atmospheric conditions

Temperature	18 ÷ 33 °C ⁽¹⁾
Relative humidity	25 ÷ 70 % ⁽²⁾
Air pressure	860 ÷ 1060 hPa

⁽¹⁾ For luminaire, temperature during tests was verified to be within 18 ÷ 30 °C

⁽²⁾ During ESD test, humidity was verified to be within 30 ÷ 60 %

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

The following equipment has been used for the monitoring of the environmental conditions:

Equipment	Manufacturer	Model	Serial N°
Thermohygrometer data loggers	Testo	175-H2	20012380/305
Thermohygrometer data loggers	Testo	175-H2	38203337/703
Barometer	Castle	GPB 3300	072015

Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ± 5 %, for which the equipment was designed.

Section 6. Measurement uncertainty

EUT	Type	Test	Range	Measurement Uncertainty	Notes
Transmitter	Conducted	Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)
		Carrier power RF Output Power	0.009 MHz ÷ 30 MHz	1.1 dB	(1)
			30 MHz ÷ 18 GHz	1.5 dB	(1)
			18 MHz ÷ 40 GHz	3.0 dB	(1)
			40 MHz ÷ 140 GHz	5.0 dB	(1)
		Adjacent channel power	1 MHz ÷ 18 GHz	1.4 dB	(1)
		Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)
		Intermodulation attenuation	1 MHz ÷ 18 GHz	2.2 dB	(1)
		Attack time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Attack time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Release time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Transient behaviour of the transmitter– Transient frequency behaviour	1 MHz ÷ 18 GHz	0.2 kHz	(1)
		Transient behaviour of the transmitter – Power level slope	1 MHz ÷ 18 GHz	9%	(1)
		Frequency deviation - Maximum permissible frequency deviation	0.001 MHz ÷ 18 GHz	1.3%	(1)
		Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz	0.001 MHz ÷ 18 GHz	0.5 dB	(1)
		Dwell time	-	3%	(1)
	Hopping Frequency Separation	0.01 MHz ÷ 18 GHz	1%	(1)	
Occupied Channel Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)		
Modulation Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)		
Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)	
		26.5 GHz ÷ 66 GHz	8.0 dB	(1)	
		66 GHz ÷ 220 GHz	10 dB	(1)	
	Effective radiated power transmitter	10 kHz ÷ 26.5 GHz	6.0 dB	(1)	
		26.5 GHz ÷ 66 GHz	8.0 dB	(1)	
		66 GHz ÷ 220 GHz	10 dB	(1)	
Receiver	Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
		Sensitivity measurement	1 MHz ÷ 18 GHz	6.0 dB	(1)
	Conducted	Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)
NOTES:					
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %					

Test	Range	Measurement Uncertainty	Notes
Automotive transients Immunity	Voltage, rise time, duration time Impulses 1, 2a, 2b, 3a, 3b and 4	(2)	(1)
Automotive transients Emission	Amplitude	10 %	(1)
	Time	10 %	
EMF for Lighting Equipment	-	26 %	(1)
Electromagnetic fields (EMF)	Magnetic, Electric and Electromagnetic fields: 0 Hz ÷ 40 GHz	26 %	(1)
Electrical quantities (voltage, current, resistance)	AC/DC Voltage 10 mV ÷ 1000 V 0÷100 kHz AC/DC Current 0.1 mA ÷ 400 A 0÷1 kHz Resistance 100 mΩ ÷ 10 MΩ	2.5 %	(1)
<p>NOTES:</p> <p>(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95 %</p> <p>(2) The instruments used for this immunity test is according to the tolerances requested by the applicable standard</p> <p>(3) The reported expanded uncertainty of measurement is related to the stimulus quantity</p>			

Section 7. Test equipment

Test equipment list

Table 0-1: Equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver 2 Hz ÷ 44 GHz	R&S	ESW44	101620	2019/08	2020/08
Broadband preamplifier	Schwarzbeck	BBV 9718	9718-137	2019/09	2020/09
Trilog Broadband Antenna	Schwarzbeck	VULB 9162	9162-025	2018/07	2021/07
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2018/09	2021/09
Antenna mast	Maturo	FCU3.0	10041	NSC	NSC
Controller	Maturo	TAM4.0-E	10042	NSC	NSC
Hydraulic revolving platform	Maturo	TT4.0-5T	2.527	NSC	NSC
High pass filter	Wainwright Instruments	WKH 1.4-15 G	4267	2018/10	2020/10
Bilog antenna 1 ÷ 18 GHz	Schwarzbeck	STLP 9148-123	123	2018/09	2021/09

NSC = Not Subject to Calibration

Section 8. Testing data

8.1 FCC 15.31(m) Number of operating frequencies

8.1.1 Definitions and limits

§ 15.31 Measurement standards.

- (m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz and less	1	Middle
1 to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

8.1.1 Test date

Start date January 28, 2020

8.1.2 Test data

Investigated frequencies	
Low frequency / channel	902.75 MHz
Mid frequency / channel	915.25 MHz
High frequency / channel	927.25 MHz

8.2 FCC 15.203 Antenna requirement

8.2.1 Definitions and limits

§ 15.203 Antenna requirement.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

8.2.2 Test date

Start date January 28, 2020

8.2.3 Test data

Detailed photo of antenna



8.3 FCC 15.207(a)(c) AC power line conducted emissions limits

8.3.1 Definitions and limits

FCC:

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Except when the requirements applicable to a given device state otherwise, for any licence-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 2. The tighter limit applies at the frequency range boundaries.

The conducted emissions shall be measured with a 50 Ω /50 μ H line impedance stabilization network (LISN).

Table 8.3-1: Conducted emissions limit

Frequency of emission, MHz	Conducted limit, dB μ V	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

Note: * - Decreases with the logarithm of the frequency.

8.3.2 Test date

Start date January 28, 2020

8.3.3 Observations, settings and special notes

The EUT was set up as tabletop configuration.

The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver settings for preview measurements:

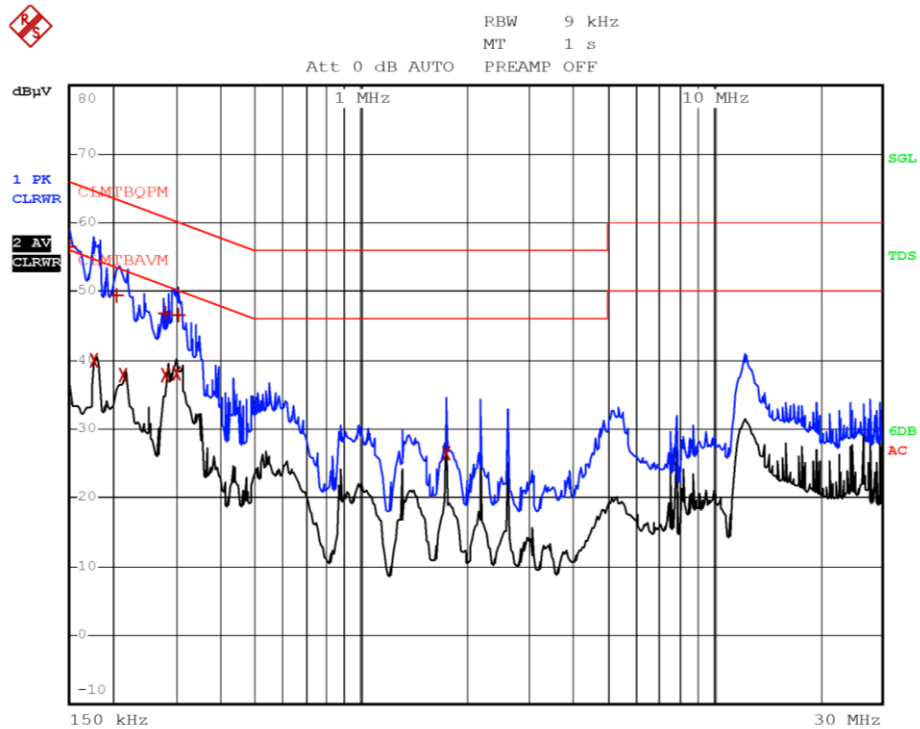
Resolution bandwidth:	9 kHz
Video bandwidth:	30 kHz
Detector mode:	Peak and Average
Trace mode:	Max Hold
Measurement time:	1000 ms

Receiver settings for final measurements:

Resolution bandwidth:	9 kHz
Video bandwidth:	30 kHz
Detector mode:	Quasi-Peak and Average
Trace mode:	Max Hold
Measurement time:	1000 ms

8.3.4 Test data

Configuration mode:1



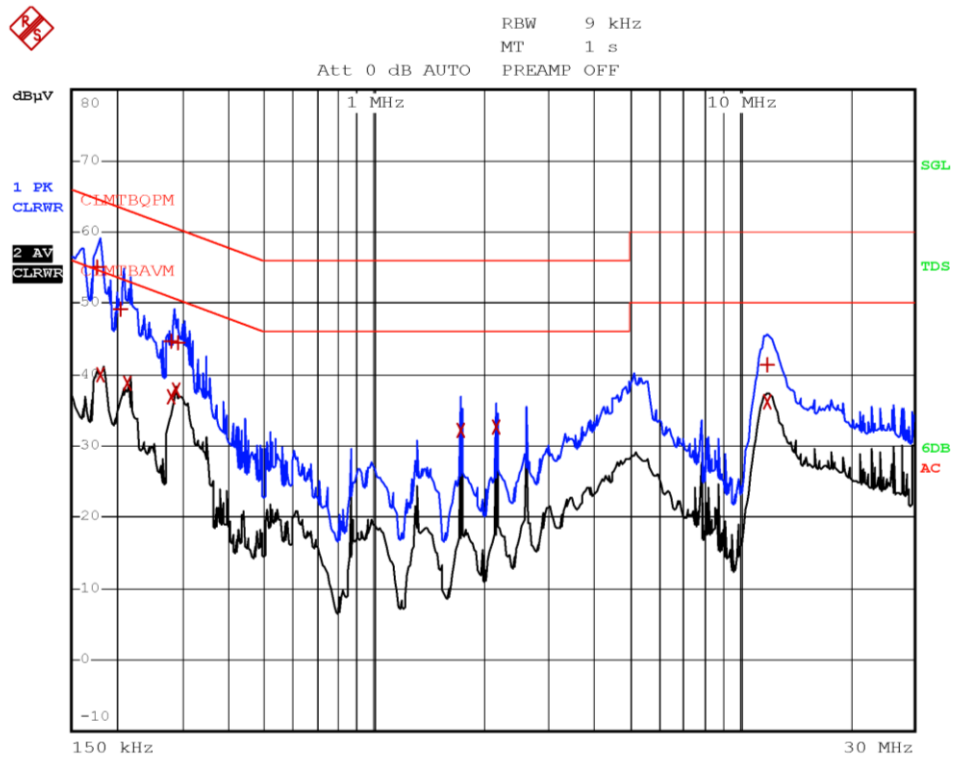
Plot 8.3-1: Conducted emissions on phase line

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Detector
0.1500	56.5	66.0	-9.5	QP
0.1780	39.9	54.6	-14.7	Av
0.2060	49.5	63.4	-13.9	QP
0.2140	37.9	53.0	-15.1	Av
0.2820	46.8	60.8	-13.9	QP
0.2820	37.9	50.8	-12.9	Av
0.2980	38.2	50.3	-12.1	Av
0.3020	46.5	60.2	-13.7	QP
1.7460	26.5	46.0	-19.5	Av

Results on phase line

8.3.1 Test data

Configuration mode:1



Plot 8.3-2: Conducted emissions on neutral line

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Detector
0.1780	55.1	64.6	-9.5	QP
0.1820	39.9	54.4	-14.5	Av
0.2060	49.1	63.4	-14.2	QP
0.2140	38.9	53.0	-14.1	Av
0.2820	44.7	60.8	-16.1	QP
0.2820	36.9	50.8	-13.9	Av
0.2860	37.9	50.6	-12.8	Av
0.2900	44.6	60.5	-15.9	QP
1.7380	32.2	46.0	-13.8	Av
2.1740	32.6	46.0	-13.4	Av
11.9700	36.3	50.0	-13.7	Av
11.9740	41.5	60.0	-18.5	QP

Results on neutral line

8.4 FCC 15.247(a)(1)(i) 20 dB Bandwidth

8.4.1 Definitions and limits

FCC:

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

8.4.2 Test date

Start date January 24, 2020

8.4.3 Observations, settings and special notes

Spectrum analyzer settings:

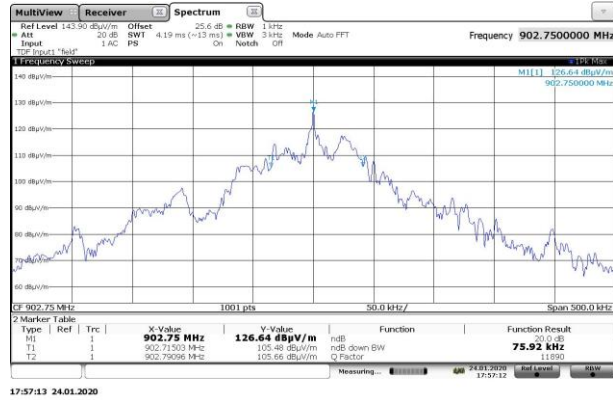
Resolution bandwidth	1% ÷ 5% OBW
Video bandwidth	≥3 × RBW
Frequency span	2 ÷ 5 OBW
Detector mode	Peak
Trace mode	Max Hold

8.4.4 Test data

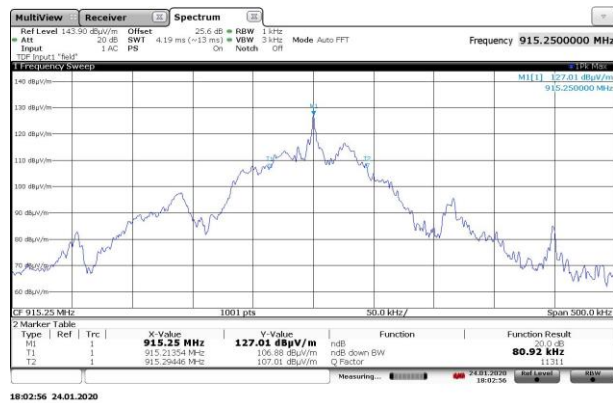
Configuration mode: 2

Table 8.4-1: 20 dB Bandwidth results

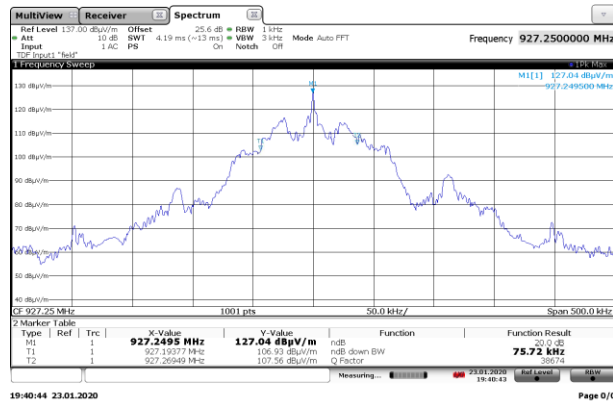
Frequency, MHz	20 dB bandwidth, kHz
902.75	75.92
915.25	80.92
927.25	75.72



CH Low



CH Mid



CH High

8.5 FCC 15.247(a)(1) Carrier frequency separation

8.5.1 Definitions and limits

FCC:

- (a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:
 - (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

8.5.2 Test date

Start date	January 24, 2020
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8.5.3 Observations, settings and special notes

Spectrum analyzer settings:

Resolution bandwidth	30 % Channel spacing
Video bandwidth	≥ RBW
Frequency span	Wide enough to capture the peaks of two adjacent channel
Detector mode	Peak
Trace mode	Max Hold

8.5.4 Test data

Configuration mode: 2



16:05:00 24.01.2020

Carrier frequency separation	500.30 kHz
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8.6 FCC 15.247(a)(1)(i) Number of hopping frequencies

8.6.1 Definitions and limits

FCC:

- (a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:
 - (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.
 - (i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

8.6.2 Test date

Start date	January 24, 2020
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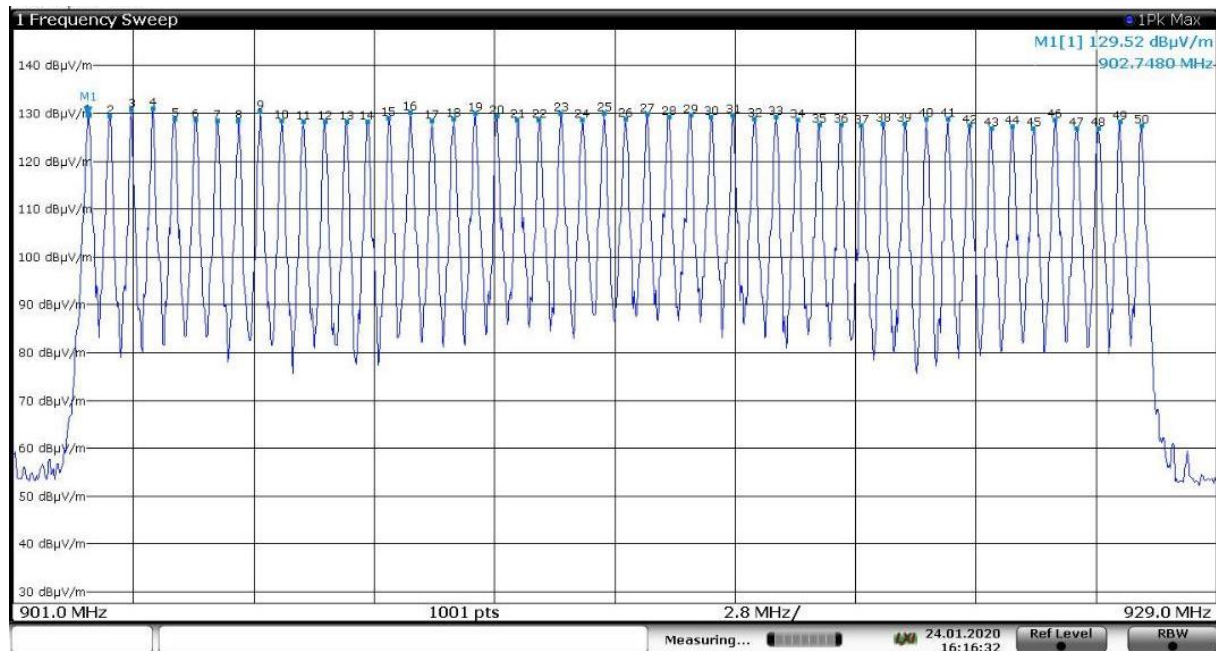
8.6.3 Observations, settings and special notes

Spectrum analyzer settings:

Resolution bandwidth	< 30 % Channel spacing or the 20 dB BW
Video bandwidth	≥RBW
Frequency span	Wide enough to capture all the peaks of the channels
Detector mode	Peak
Trace mode	Max Hold

8.6.4 Test data

Configuration mode: 2



16:16:33 24.01.2020

Number of frequency hopping	50
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8.7 FCC 15.247(a)(1)(i) Average time of occupancy

8.7.1 Definitions and limits

FCC:

- (a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:
 - (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.
 - (i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

8.7.2 Test date

Start date	January 24, 2020
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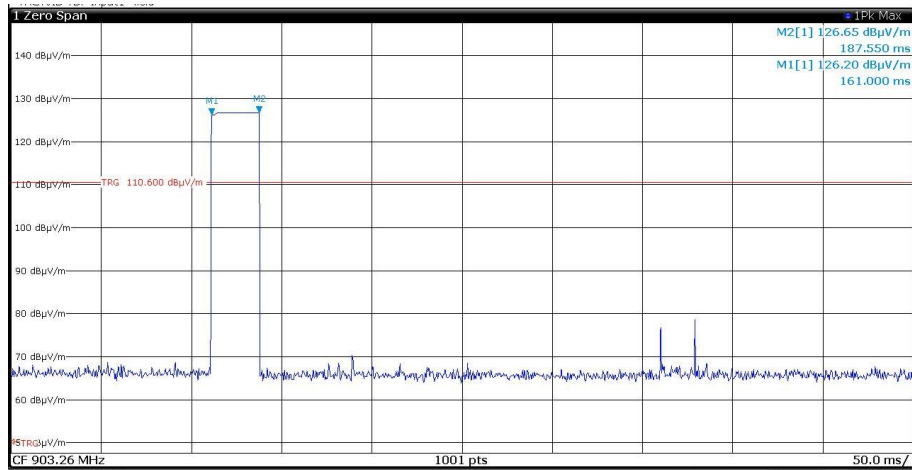
8.7.3 Observations, settings and special notes

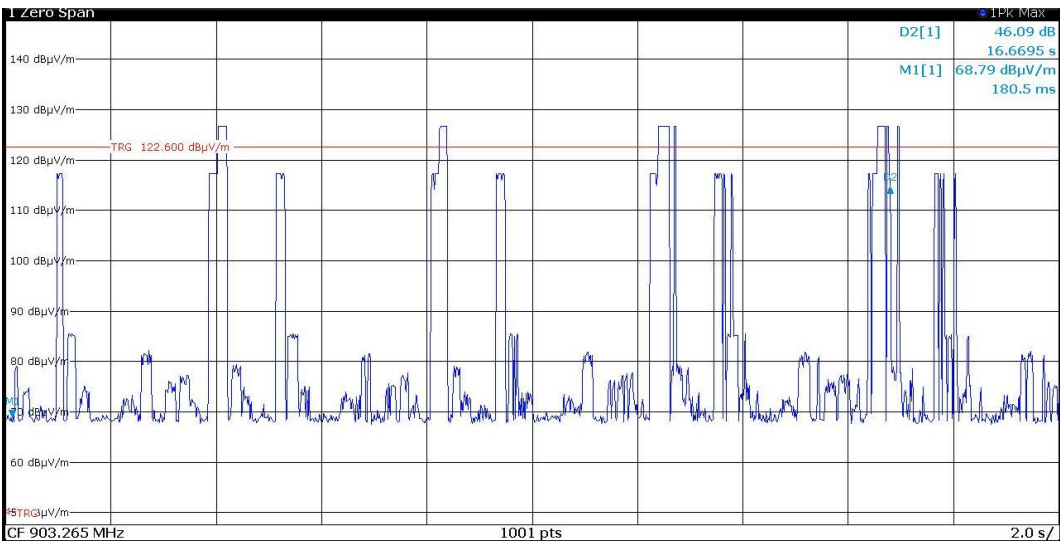
Spectrum analyzer settings:

Resolution bandwidth	≤ Channel spacing
Video bandwidth	≥ RBW
Frequency span	Zero span
Detector mode	Peak
Trace mode	Max Hold

8.7.4 Test data

Configuration mode: 2





T = Transmit time per hop	26.55 ms
N = Number of hops in the period (20 s)	4
A = Average time of occupancy = T * N	106.2 ms = 0.1 s < 0.4 s

8.8 FCC 15.247 (b)(2)(4) Maximum peak output power

8.8.1 Definitions and limits

FCC:

- b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
- 2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.
 - 4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.8.2 Test date

Start date January 24, 2020

8.8.3 Observations, settings and special notes

Spectrum analyzer settings:

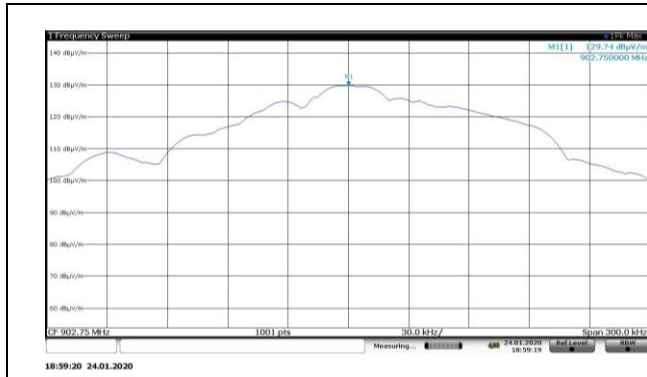
Resolution bandwidth	>20 dB BW
Video bandwidth	≥RBW
Frequency span	5*20 dB BW
Detector mode	Peak
Trace mode	Max Hold

8.8.4 Test data

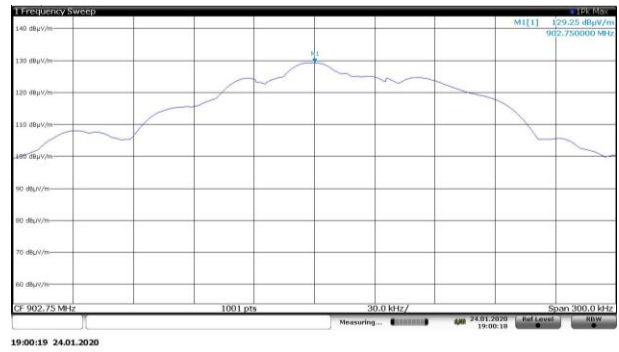
Configuration mode: 2; Measuring distance: 3 m

Conducted limit calculation: $30 \text{ dBm} - (\text{exceeding value between the antenna gain and } 6 \text{ dBi}) = 30 \text{ dBm} - 3 \text{ dB} = 27 \text{ dBm}$
exceeding value between the antenna gain and 6 dBi = max Antenna Gain [dBi] – 6 dBi = 9 dBi – 6 dBi = 3 dBm

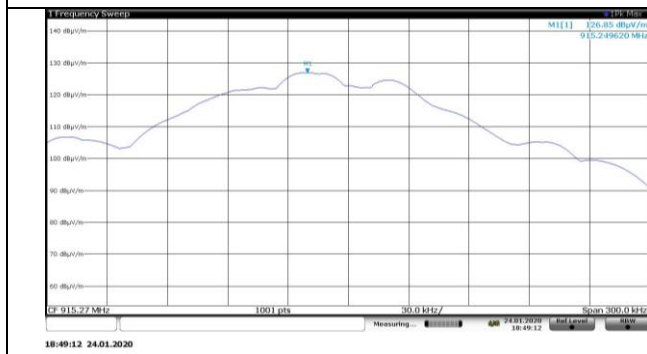
Frequency (MHz)	Polarization	Radiated output power (dBμV/m)	Eirp (dBm)	Antenna gain (dBi)	Conducted output power (dBm)	Conducted Limit (dBm)	Verdict
902.7500	V	129.7	34.5	9	25.5	27	Pass
902.7500	H	129.3	34.1	9	25.1	27	Pass
915.2500	V	126.9	31.7	9	22.7	27	Pass
915.2500	H	128.4	33.2	9	24.2	27	Pass
927.2500	V	127.3	32.1	9	23.1	27	Pass
927.2500	H	124.1	28.9	9	19.9	27	Pass



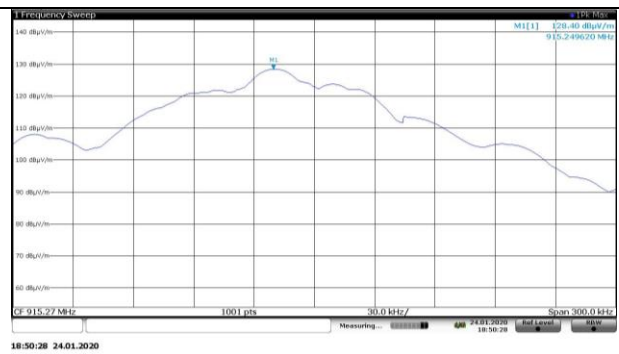
Channel LOW, pol H



Channel LOW, pol V



Channel MID, pol H



Channel MID, pol V



Channel HIGH, pol H



Channel HIGH, pol V

8.9 FCC 15.247(d), Spurious (out-of-band) unwanted emissions

8.9.1 Definitions and limits

FCC 15.247(d) Spurious

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, 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)).

Table 8.9-1: FCC §15.209 – Radiated emission limits

Frequency, MHz	Field strength of emissions		Measurement distance, m
	μV/m	dBμV/m	
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.

For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

Table 8.9-2: FCC restricted frequency bands

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

8.9.2 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.

All measurements were performed using a peak detector.

RBW within 30–1000 MHz was 100 kHz and 1 MHz above 1 GHz. VBW was wider than RBW.

Spectrum analyzer settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyzer settings for peak radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyzer settings for average conducted measurements within restricted bands above 1 GHz:

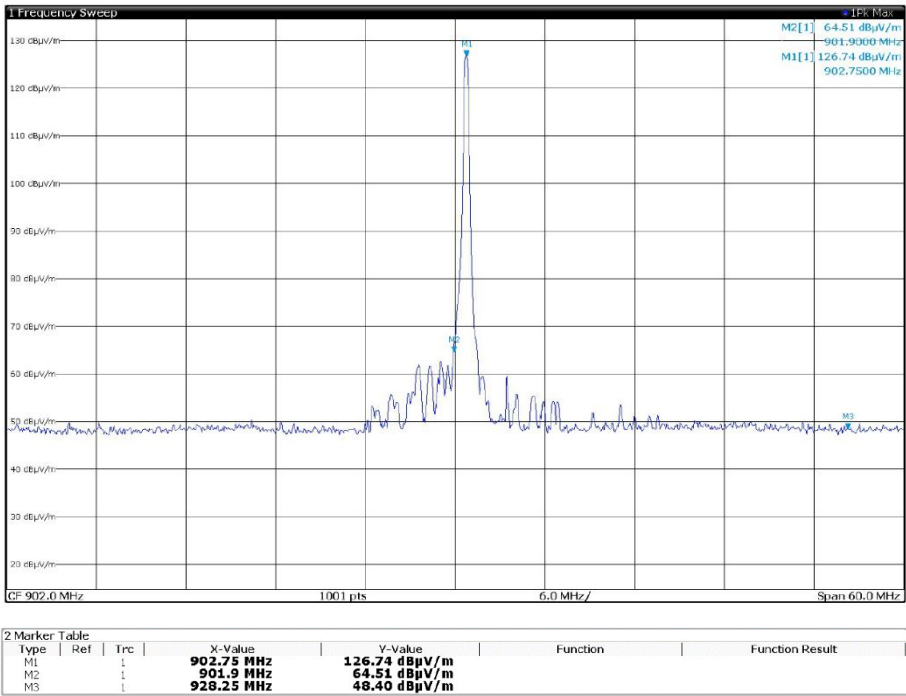
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	power averaging (RMS)
Trace mode:	averaging (RMS)

Spectrum analyzer settings for average radiated measurements within restricted bands above 1 GHz:

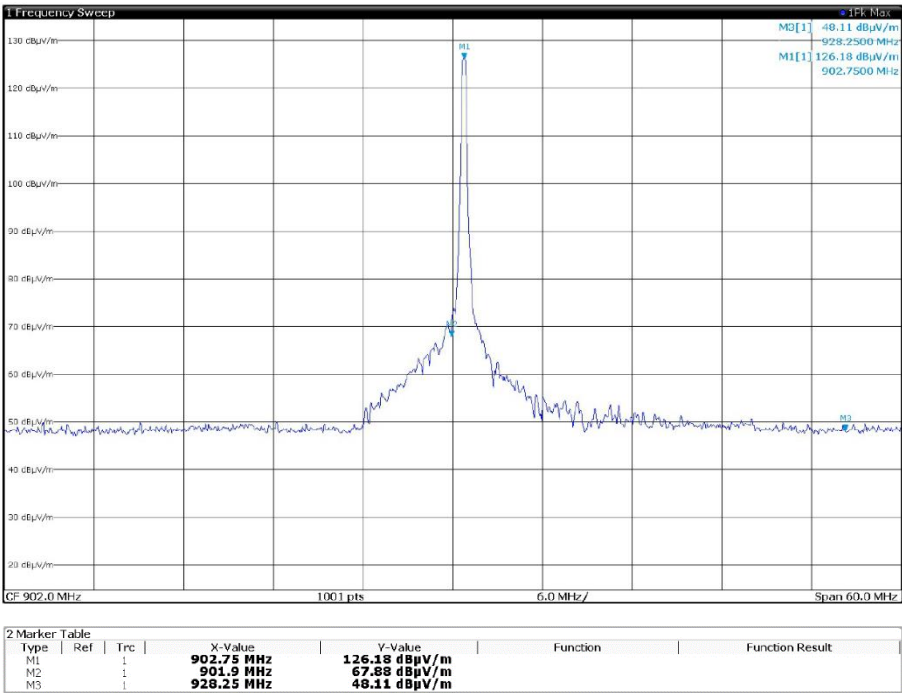
Resolution bandwidth:	1 MHz
Video bandwidth:	10 Hz
Detector mode:	Peak
Trace mode:	Max Hold

Restricted-band band-edge measurements

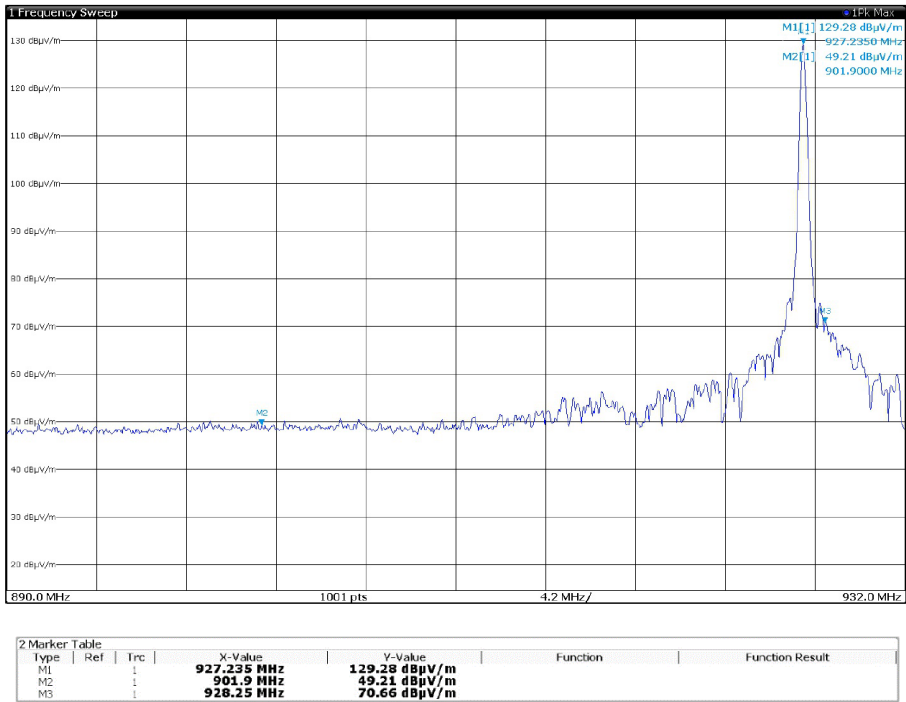
Fix CH LOW Horizontal



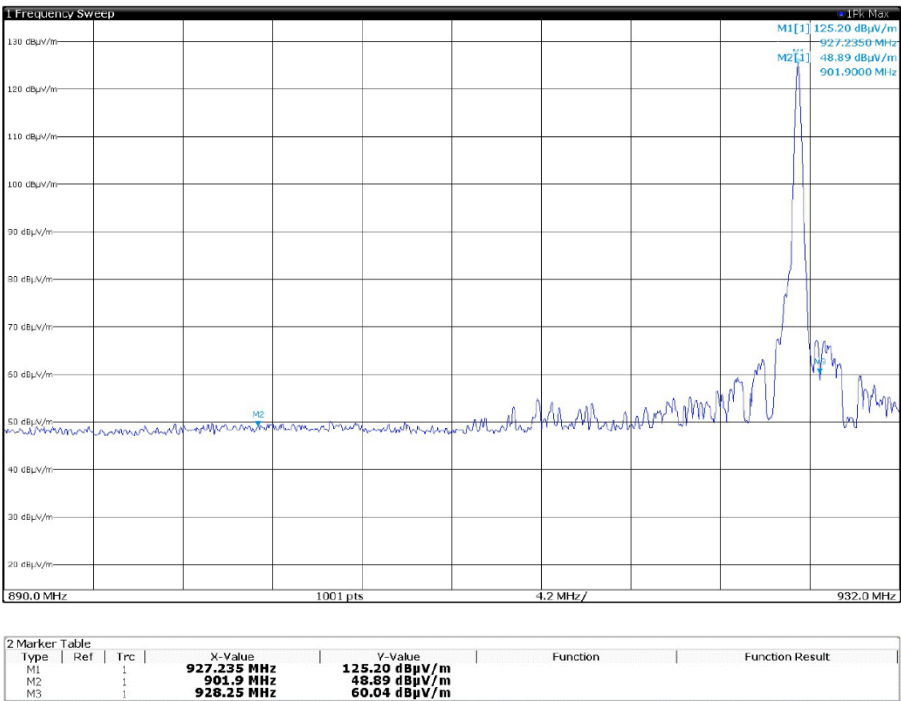
Fix CH LOW Vertical



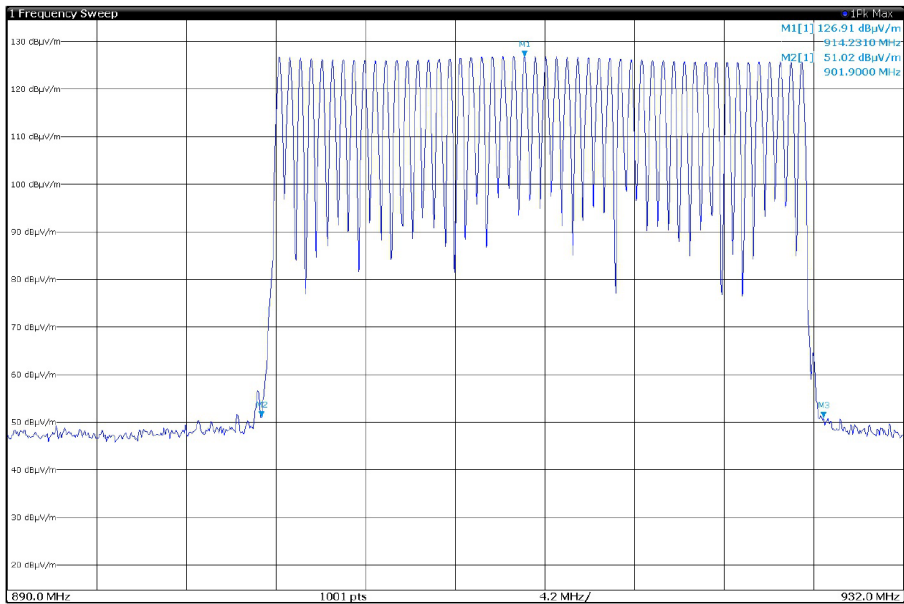
Fix CH HIGH Horizontal



Fix CH HIGH Vertical

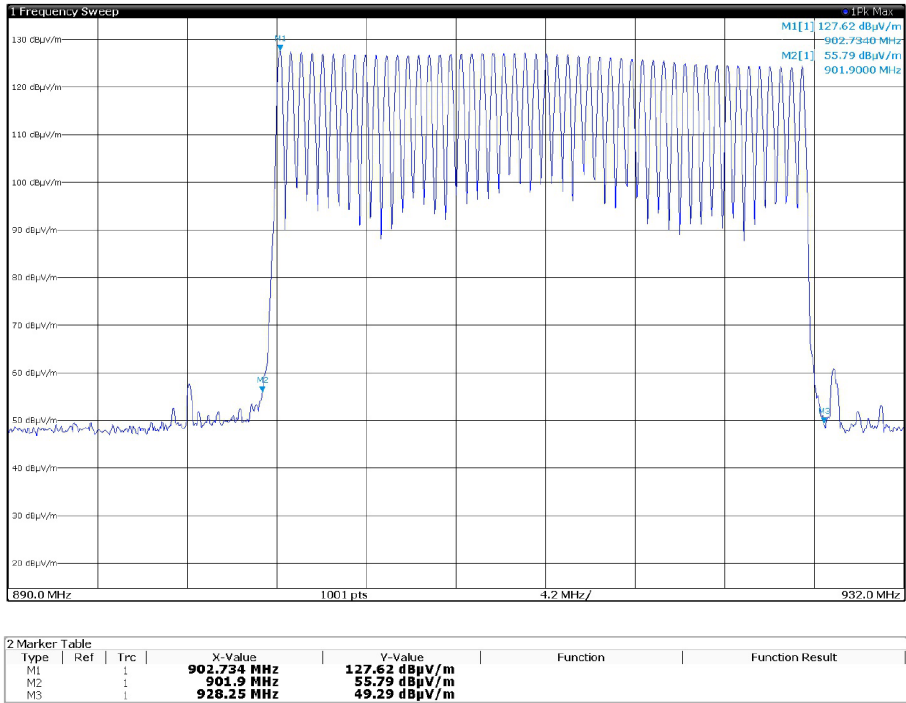


Frequency Hopping Horizontal



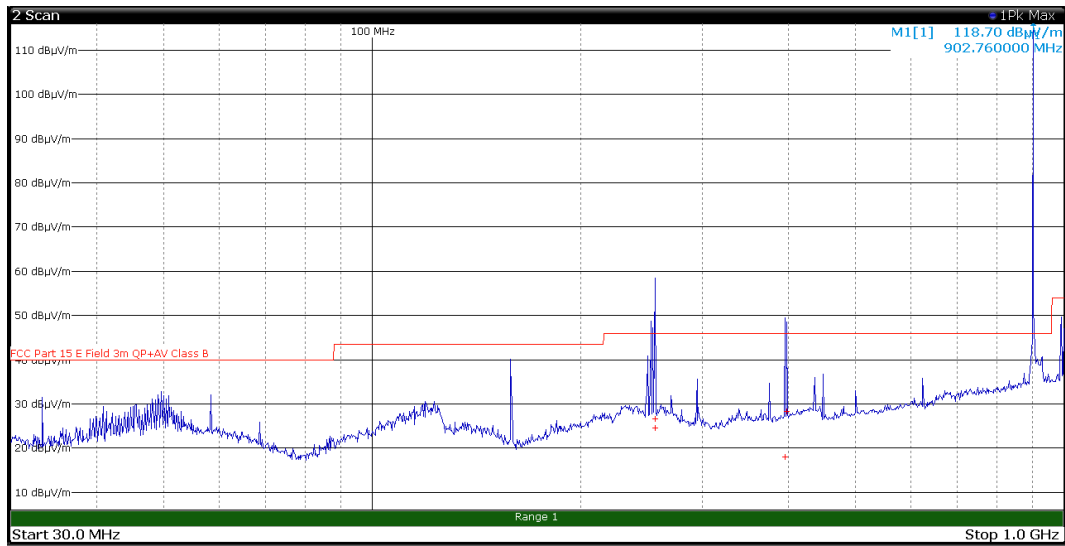
2 Marker Table					
Type	Ref	Trc	X-Value	Y-Value	Function
M1	1		914.231 MHz	126.91 dBµV/m	
M2	1		901.9 MHz	51.02 dBµV/m	
M3	1		928.25 MHz	50.92 dBµV/m	

Frequency Hopping Vertical



Spurious radiated measurement

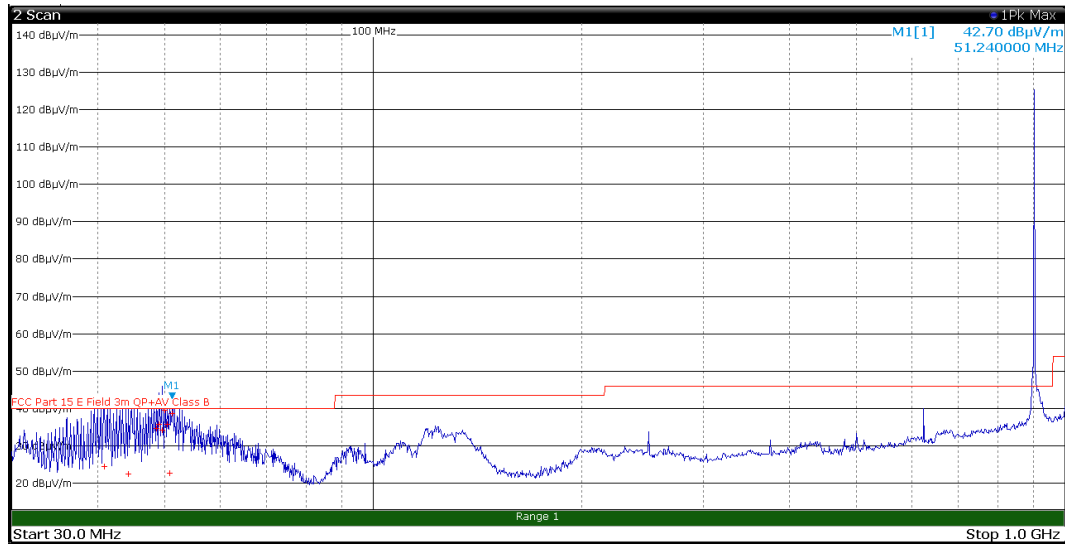
CH LOW HORIZONTAL



Frequency range: 30 MHz to 1 GHz

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
256.2000	26.7	46.0	-19.3	QP
256.4400	24.5	46.0	-21.5	QP
395.5600	18.1	46.0	-27.9	QP
397.2000	28.3	46.0	-17.7	QP

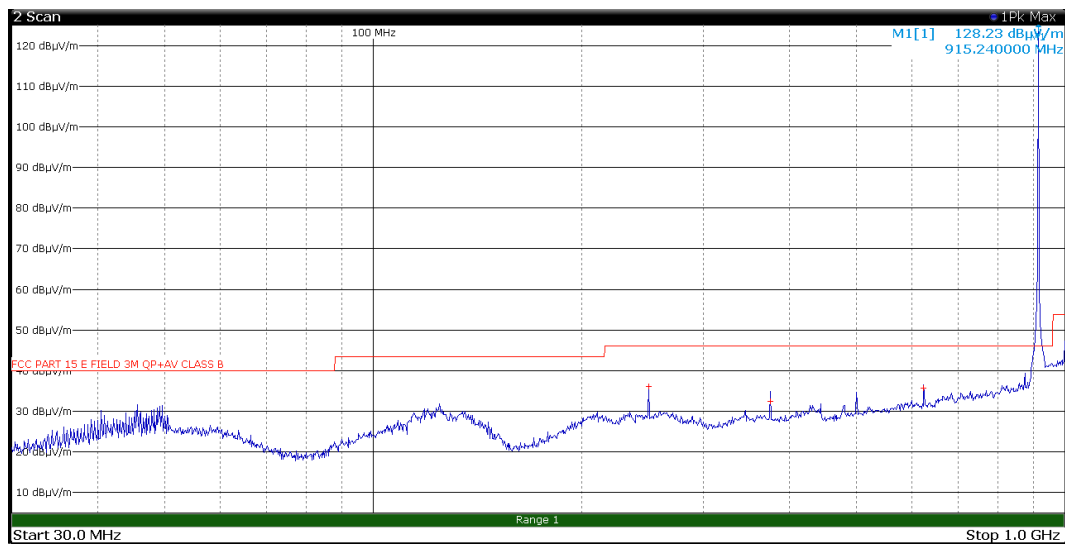
CH LOW VERTICAL



Frequency range: 30 MHz to 1 GHz

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
40.8000	24.6	40.0	-15.4	QP
44.2800	22.6	40.0	-17.4	QP
48.6400	34.7	40.0	-5.3	QP
49.0400	35.9	40.0	-4.1	QP
49.4800	34.3	40.0	-5.7	QP
49.9200	39.7	40.0	-0.3	QP
50.3200	35.8	40.0	-4.2	QP
50.8000	22.8	40.0	-17.2	QP
51.2400	38.7	40.0	-1.3	QP

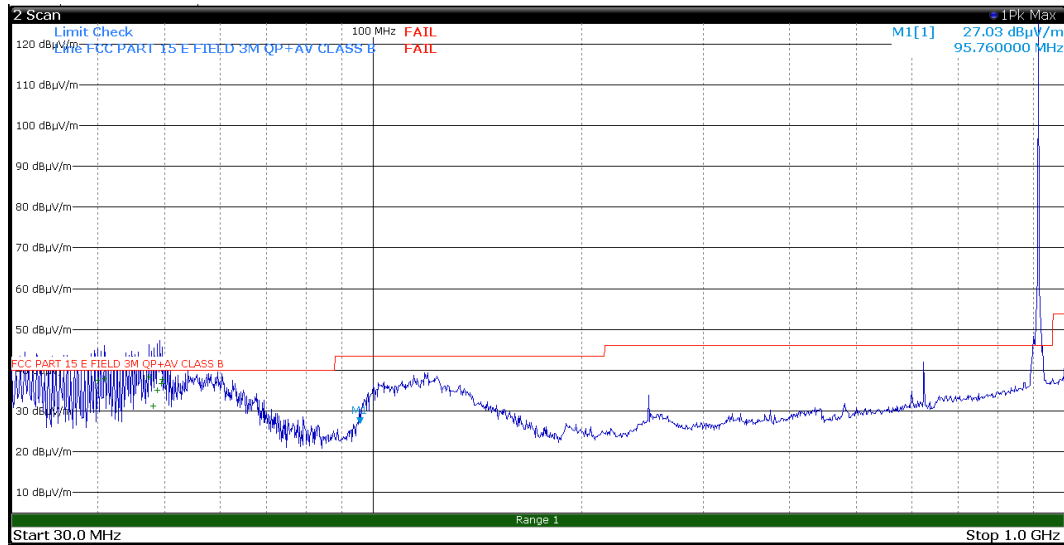
CH MID HORIZONTAL



Frequency range: 30 MHz to 1 GHz

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
250.0000	36.2	46.0	-9.8	QP
375.0400	32.6	46.0	-13.4	QP
625.0400	35.7	46.0	-10.3	QP

CH MID VERTICAL

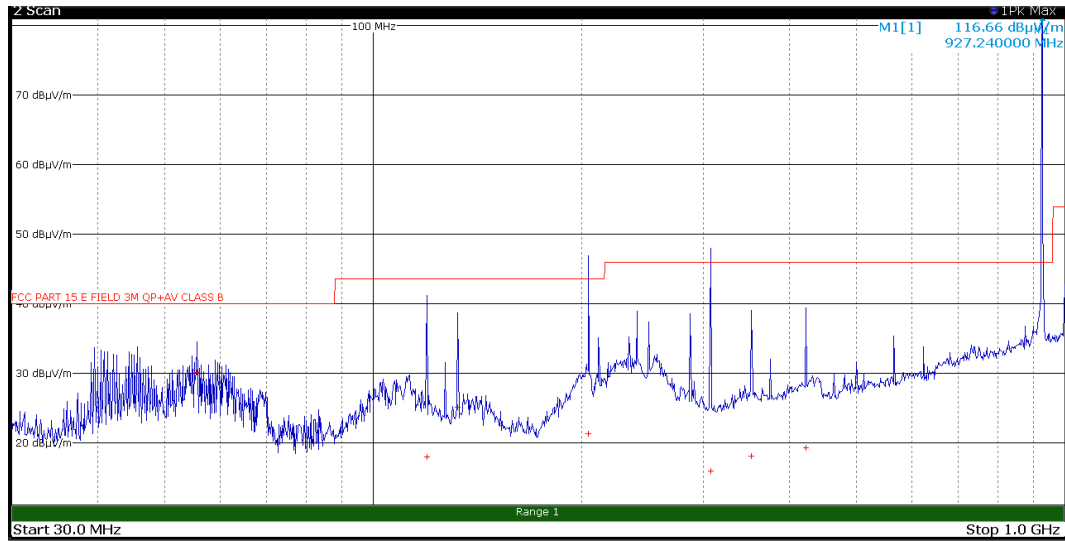


Frequency range: 30 MHz to 1 GHz

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
31.3200	42.5	40.0	2.4*	QP
40.0000	37.7	40.0	-2.3	QP
40.8800	38.1	40.0	-1.9	QP
44.7600	40.6	40.0	0.5*	QP
47.4000	38.5	40.0	-1.5	QP
48.0000	31.2	40.0	-8.8	QP
48.7200	35.1	40.0	-4.9	QP
49.1200	42.4	40.0	2.3*	QP
49.4000	36.9	40.0	-3.1	QP
49.5600	37.8	40.0	-2.2	QP

* the emissions are related to the digital circuitry and not the radio

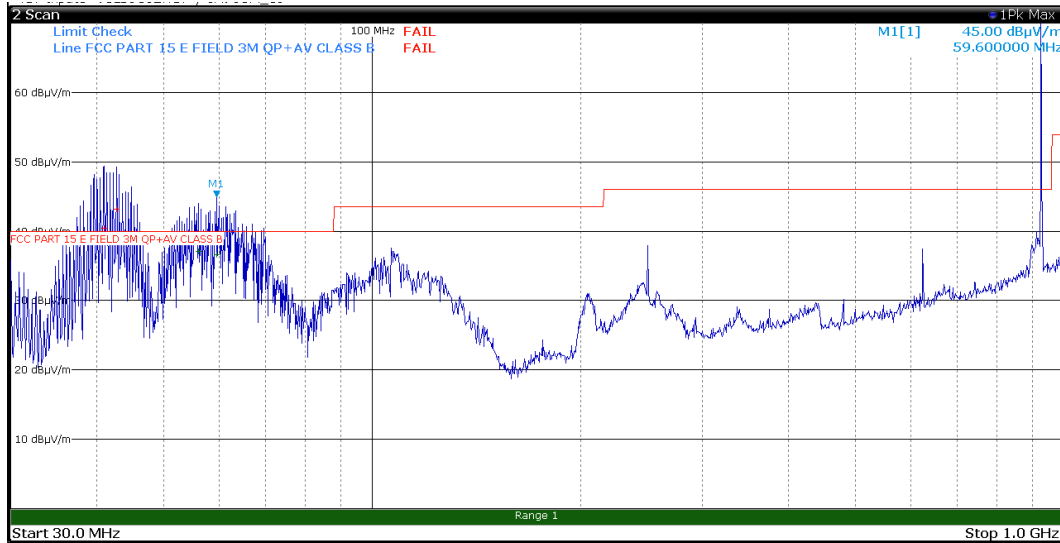
CH HIGH HORIZONTAL



Frequency range: 30 MHz to 1 GHz

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
55.6000	30.1	40.0	-9.9	QP
119.5200	18.0	43.5	-25.5	QP
132.4400	25.1	43.5	-18.4	QP
204.8000	21.3	43.5	-22.2	QP
307.7200	15.9	46.0	-30.1	QP
351.9200	18.1	46.0	-27.9	QP
422.2400	19.3	46.0	-26.7	QP

CH HIGH VERTICAL

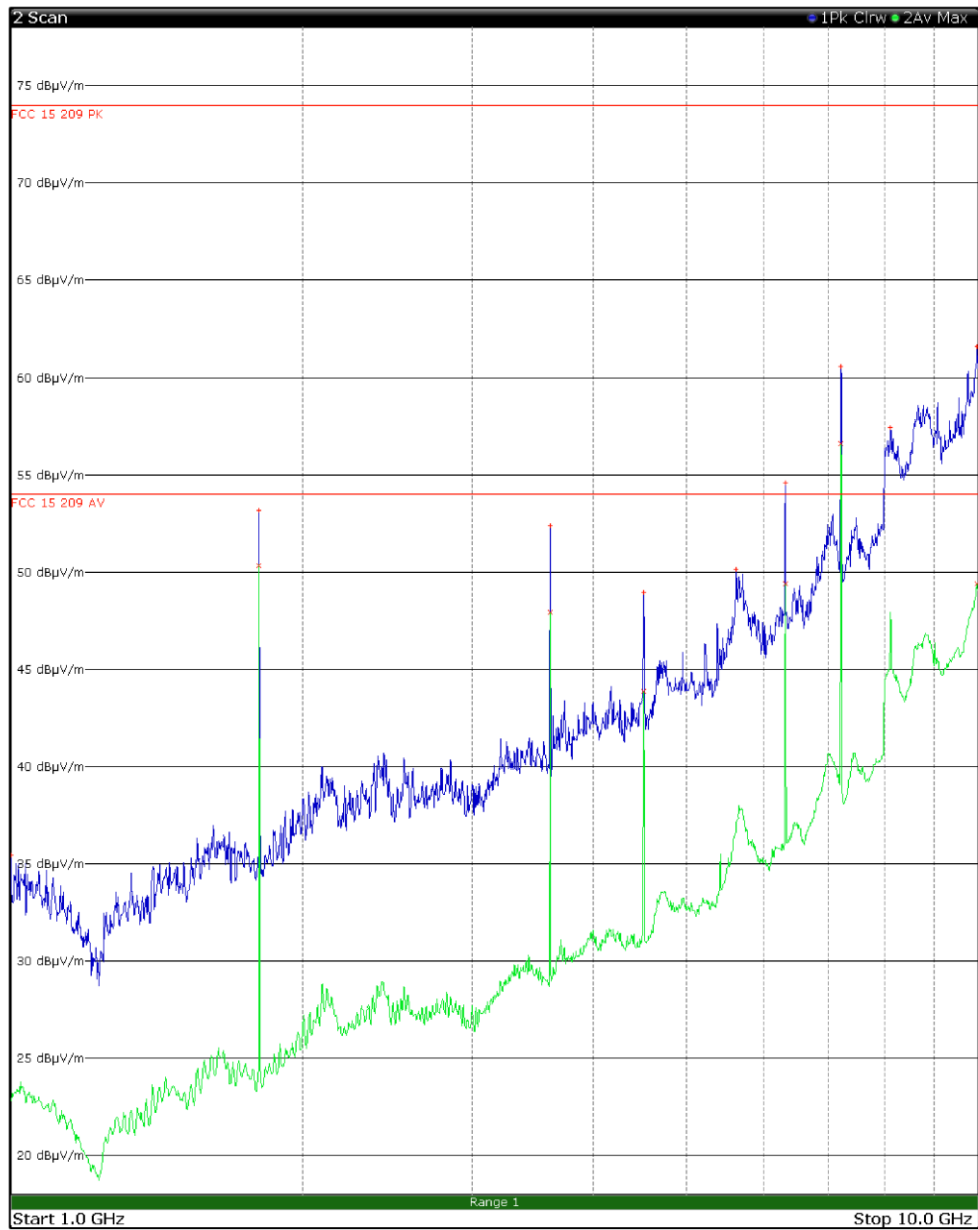


Frequency range: 30 MHz to 1 GHz

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
37.8400	38.8	40.0	-1.2	QP
38.2400	38.9	40.0	-1.1	QP
40.9200	40.4	40.0	0.4*	QP
42.6400	43.3	40.0	3.2*	QP
56.1200	37.2	40.0	-2.8	QP
59.6000	36.6	40.0	-3.4	QP

* the emissions are related to the digital circuitry and not the radio

CH LOW HORIZONTAL



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Page 1/1

CH LOW HORIZONTAL

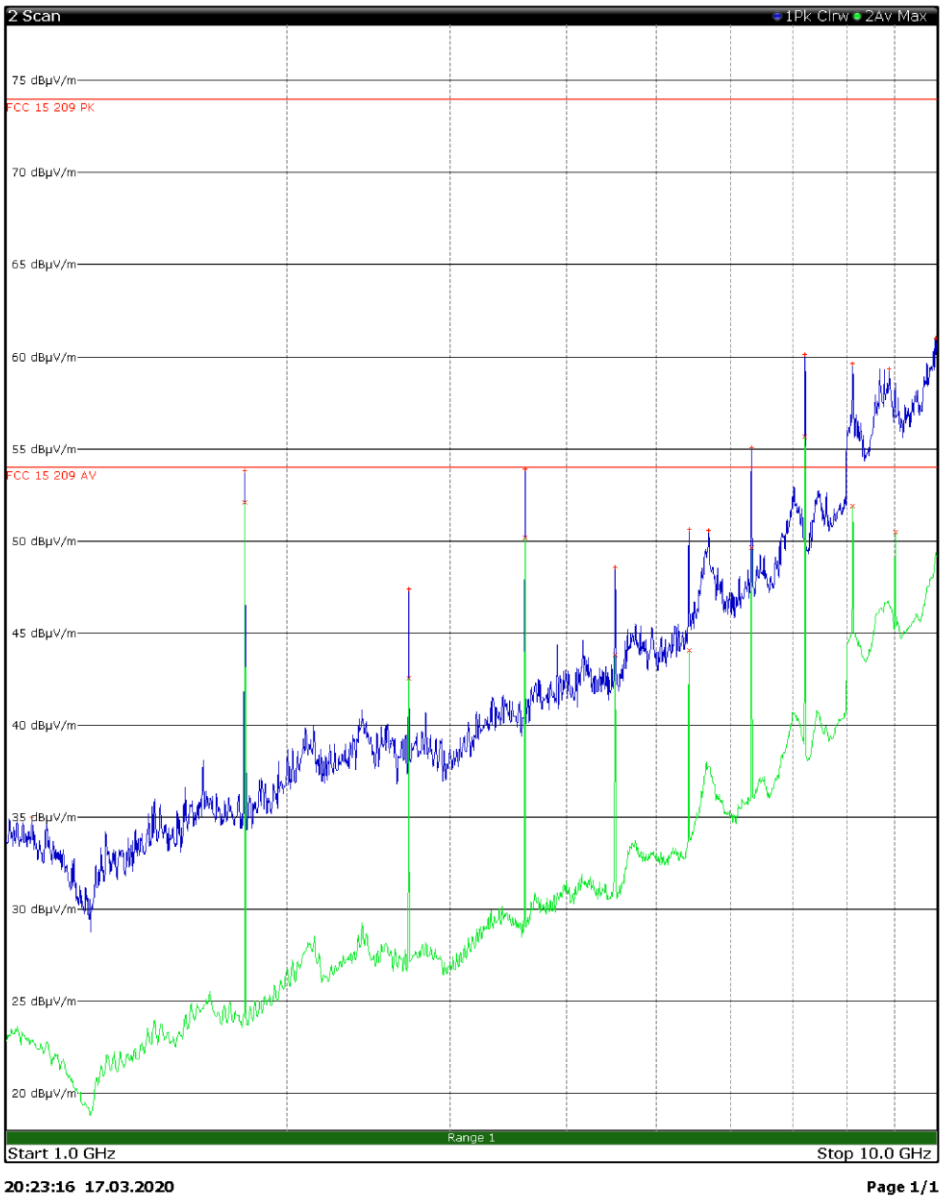
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement:

The highest level of carrier is 129.7 dBuV/m, any spurious emission due to intentional radiator shall be attenuated of 20 dB;

Spurious emission limits= 129.7 dBuV/m-20 dB=109.7 dBuV/m.

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1000.2500	35.5	74.0	-38.5	Pk
1805.5000	53.2	109.7	-56.5	Pk
1805.5000	50.4	--	--	Av
3611.0000	52.4	74.0	-21.6	Pk
3611.0000	48.0	54.0	-6.0	Av
4513.7500	49.0	74.0	-25.0	Pk
4513.7500	43.9	54.0	-10.1	Av
5620.2500	50.2	109.7	-59.5	Pk
6319.2500	54.6	109.7	-55.1	Pk
6319.2500	49.5	--	--	Av
7222.0000	60.6	109.7	-49.1	Pk
7222.0000	56.6	--	--	Av
8124.7500	57.5	74.0	-16.5	Pk
9980.5000	49.5	--	--	Av
9982.2500	61.6	109.7	-48.1	Pk

CH LOW VERTICAL



CH LOW VERTICAL

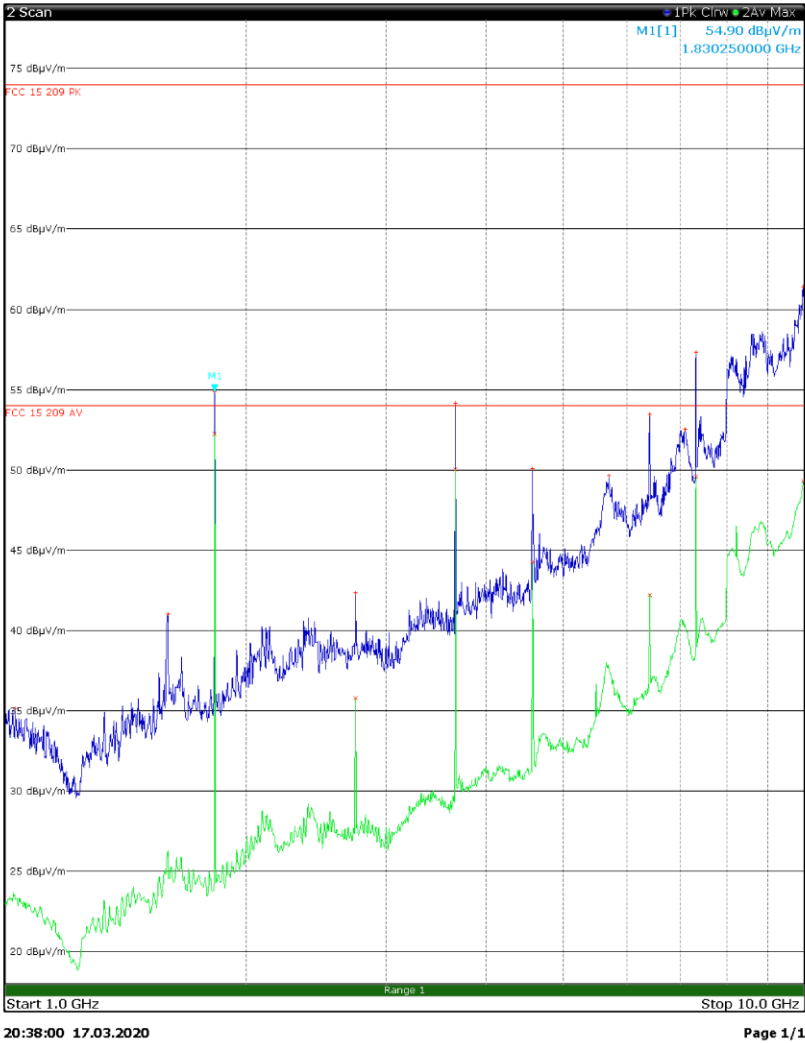
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement:

The highest level of carrier is 129.7 dBuV/m, any spurious emission due to intentional radiator shall be attenuated of 20 dB;

Spurious emission limits= 129.7 dBuV/m-20 dB=109.7 dBuV/m.

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1065.5000	35.1	74.0	-38.9	Pk
1805.5000	53.9	109.7	-55.8	Pk
1805.5000	52.1	--	--	Av
2708.2500	47.4	74.0	-26.6	Pk
2708.2500	42.6	54.0	-11.4	Av
3611.0000	53.9	74.0	-20.1	Pk
3611.0000	50.2	54.0	-3.8	Av
4513.7500	48.6	74.0	-25.4	Pk
4513.7500	43.8	54.0	-10.2	Av
5416.5000	50.7	74.0	-23.3	Pk
5416.5000	44.1	54.0	-9.9	Av
5689.2500	50.6	109.7	-59.1	Pk
6319.2500	55.1	109.7	-54.6	Pk
6319.2500	49.7	--	--	Av
7222.0000	60.2	109.7	-49.5	Pk
7222.0000	55.7	--	--	Av
8124.7500	59.7	74.0	-14.3	Pk
8124.7500	51.9	54.0	-2.1	Av
8891.5000	59.4	109.7	-50.3	Pk
9026.2500	50.5	54.0	-3.5	Av
9966.5000	61.1	109.7	-48.6	Pk

CH MID HORIZONTAL



CH MID HORIZONTAL

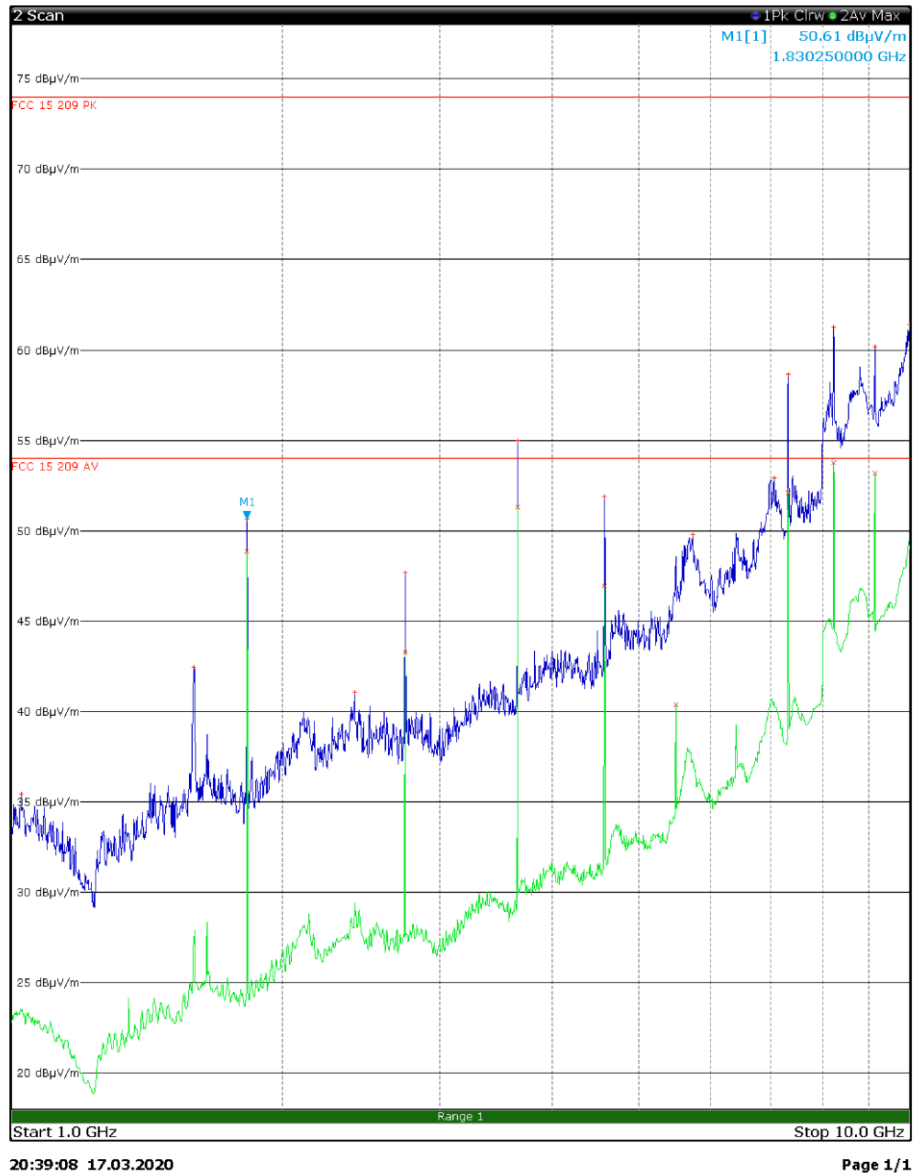
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement:

The highest level of carrier is 129.7 dBuV/m, any spurious emission due to intentional radiator shall be attenuated of 20 dB;

Spurious emission limits= 129.7 dBuV/m-20 dB=109.7 dBuV/m.

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1029.2500	35.2	74.0	-38.8	Pk
1599.5000	41.1	74.0	-32.9	Pk
1830.5000	54.9	109.7	-54.8	Pk
1830.5000	52.3	--	--	Av
2745.7500	42.4	74.0	-31.6	Pk
2745.7500	35.8	54.0	-18.2	Av
3661.0000	54.2	74.0	-19.8	Pk
3661.0000	50.1	54.0	-3.9	Av
4576.2500	50.1	74.0	-23.9	Pk
4576.2500	44.3	54.0	-9.7	Av
5697.0000	49.7	109.7	-60.0	Pk
6406.7500	53.5	109.7	-56.2	Pk
6406.7500	42.3	--	--	Av
7093.0000	52.6	109.7	-57.1	Pk
7322.0000	57.4	74.0	-16.6	Pk
7322.0000	49.6	54.0	-4.4	Av
9969.5000	61.4	109.7	-48.3	Pk
9980.2500	49.3	--	--	Av

CH MID VERTICAL



CH MID VERTICAL

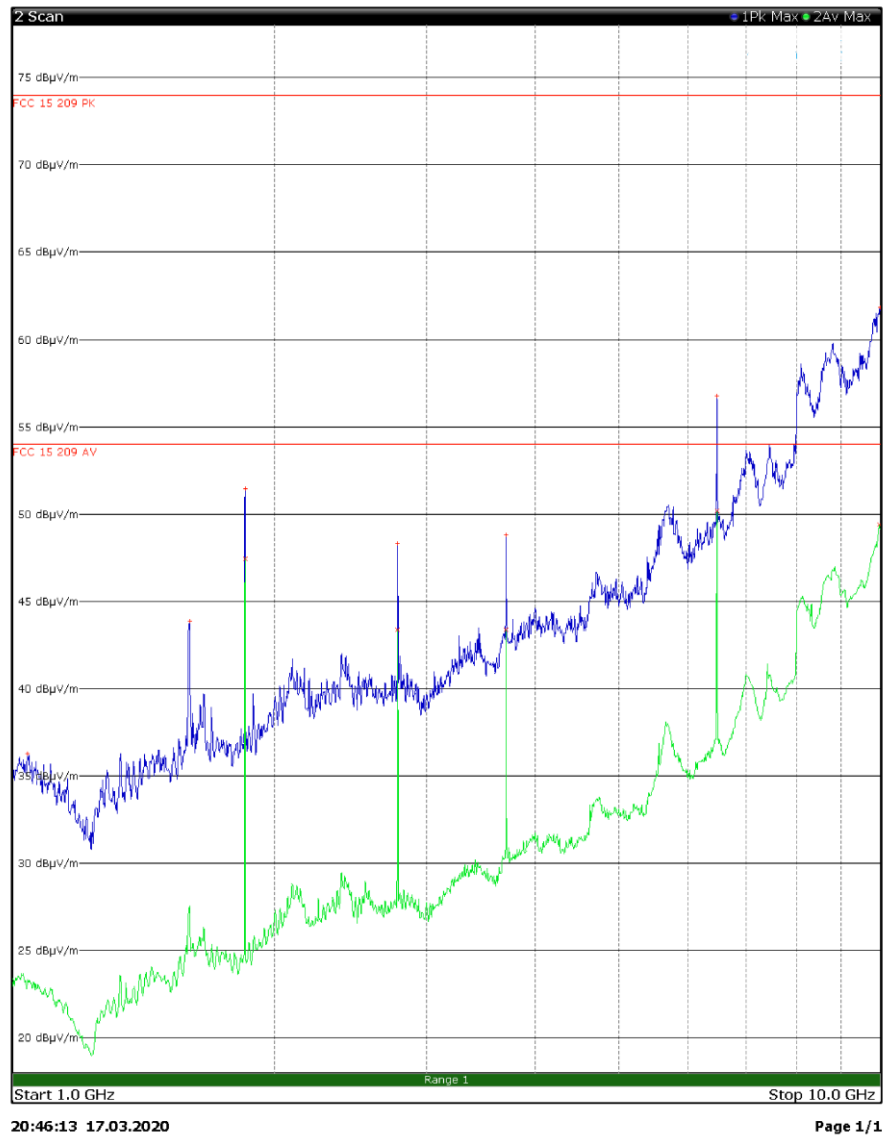
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement:

The highest level of carrier is 129.7 dBuV/m, any spurious emission due to intentional radiator shall be attenuated of 20 dB;

Spurious emission limits= 129.7 dBuV/m-20 dB=109.7 dBuV/m.

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1025.0000	35.5	74.0	-38.5	Pk
1597.5000	42.5	74.0	-31.5	Pk
1830.5000	50.7	109.7	-59.0	Pk
1830.5000	48.9	--	--	Av
2411.7500	41.1	109.7	-68.6	Pk
2745.7500	47.7	74.0	-26.3	Pk
2745.7500	43.3	54.0	-10.7	Av
3661.0000	55.0	74.0	-19.0	Pk
3661.0000	51.4	54.0	-2.6	Av
4576.2500	52.0	74.0	-22.0	Pk
4576.2500	47.0	54.0	-7.0	Av
5491.5000	40.4	--	--	Av
5733.0000	49.8	109.7	-59.9	Pk
7061.0000	53.0	109.7	-56.7	Pk
7322.0000	58.7	74.0	-15.3	Pk
7322.0000	52.1	54.0	-1.9	Av
8237.2500	61.3	74.0	-12.7	Pk
8237.2500	53.7	54.0	-0.3	Av
9152.5000	60.2	74.0	-13.8	Pk
9152.5000	53.2	54.0	-0.8	Av
9998.7500	61.4	109.7	-48.3	Pk

CH HIGH HORIZONTAL



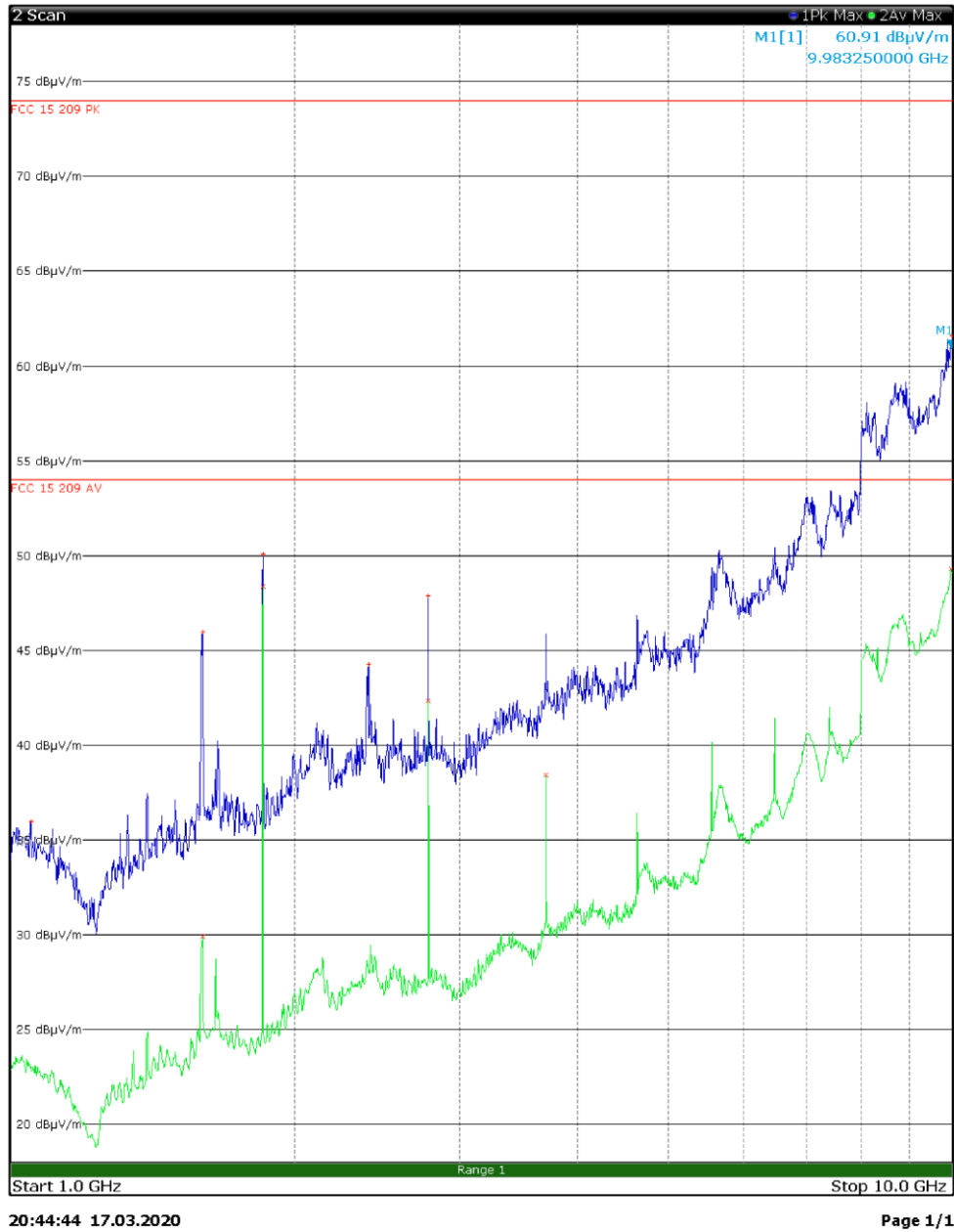
CH HIGH HORIZONTAL

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement:

The highest level of carrier is 129.7 dBuV/m, any spurious emission due to intentional radiator shall be attenuated of 20 dB;
Spurious emission limits= 129.7 dBuV/m-20 dB=109.7 dBuV/m.

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1039.0000	36.3	74.0	-37.7	Pk
1598.7500	43.9	74.0	-30.1	Pk
1854.5000	51.5	109.7	-58.2	Pk
1854.5000	47.5	--	--	Av
2781.7500	43.4	54.0	-10.6	Av
2781.7500	48.4	74.0	-25.6	Pk
3709.0000	48.8	74.0	-25.2	Pk
3709.0000	43.4	54.0	-10.6	Av
6490.7500	56.8	109.7	-52.9	Pk
6490.7500	50.2	--	--	Av
9980.7500	49.4	--	--	Av
9989.7500	61.9	109.7	-47.8	Pk

CH HIGH VERTICAL



CH HIGH VERTICAL

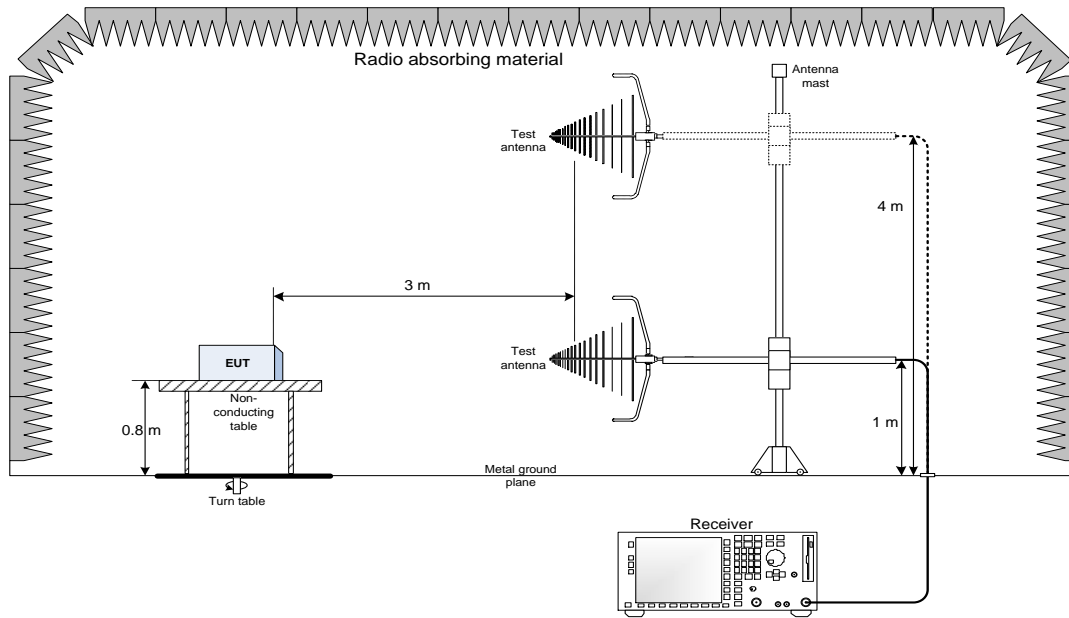
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement:

The highest level of carrier is 129.7 dBuV/m, any spurious emission due to intentional radiator shall be attenuated of 20 dB;
Spurious emission limits= 129.7 dBuV/m-20 dB=109.7 dBuV/m.

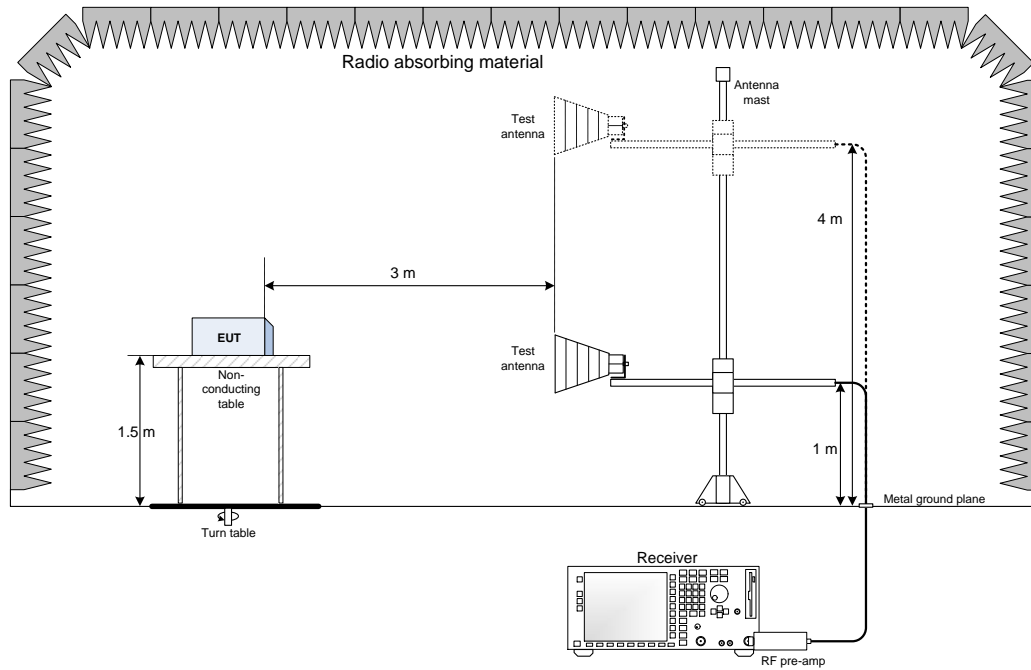
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1050.0000	36.0	74.0	-38.0	Pk
1597.7500	46.0	74.0	-28.0	Pk
1598.7500	29.9	54.0	-24.1	Av
1854.5000	50.1	109.7	-59.6	Pk
1854.5000	48.4	--	--	Av
2398.0000	44.3	109.7	-65.4	Pk
2781.7500	47.9	74.0	-26.1	Pk
2781.7500	42.4	54.0	-11.6	Av
3702.7500	38.5	54.0	-15.5	Av
9982.0000	49.3	--	--	Av

Section 9. Block diagrams of test set-ups

Radiated emissions set-up for frequencies below 1 GHz



Radiated emissions set-up for frequencies above 1 GHz



Section 10. Photo of test set-up and EUT

PHOTO OF TEST SET-UP

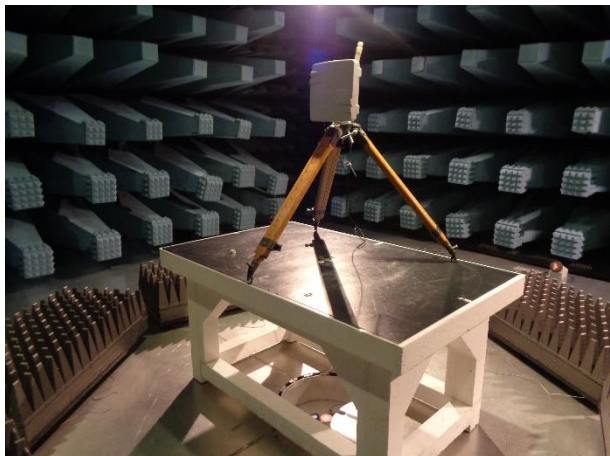
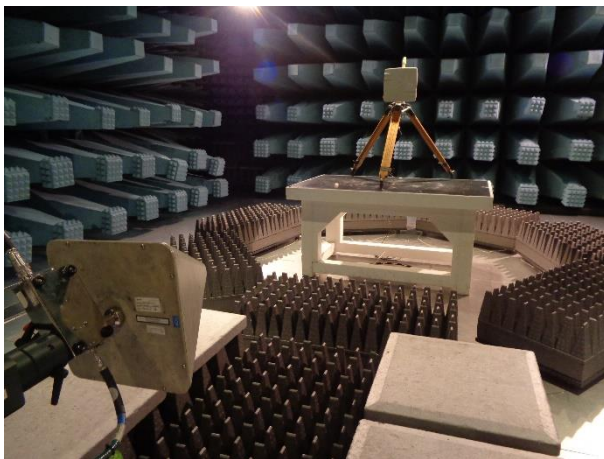
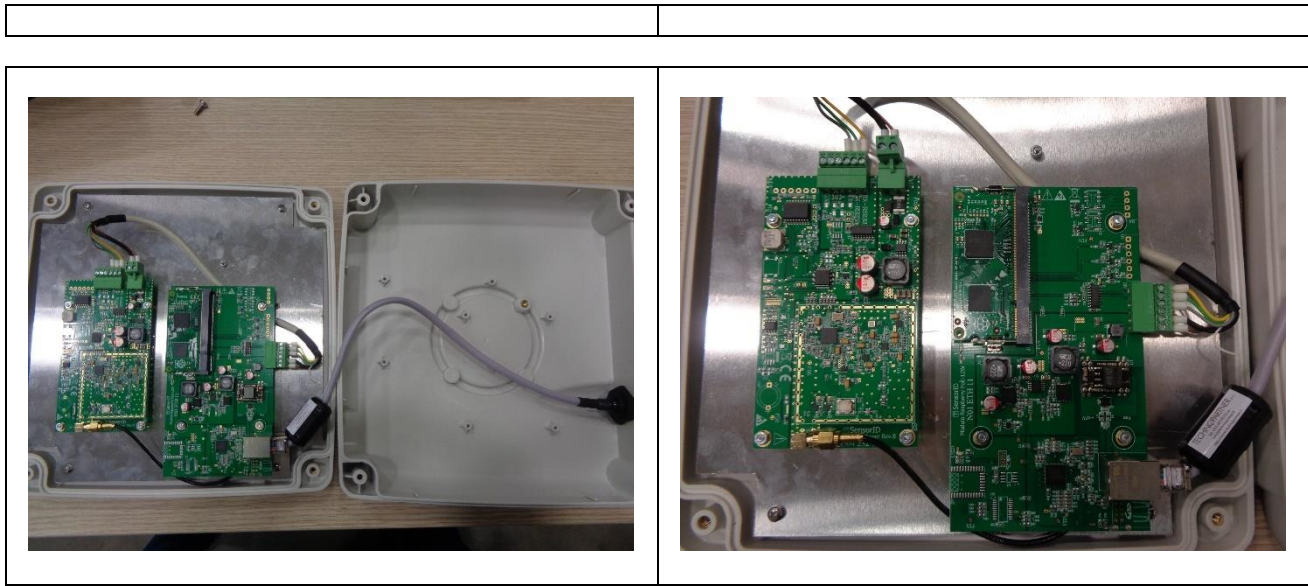


PHOTO OF EUT





END OF REPORT