

Prüfbericht-Nr.: Test Report No.:	60321881-002	Auftrags-Nr.: Order No.:	3309944_30	Seite 1 von 43 Page 1 of 43
Kunden-Referenz-Nr.: Client Reference No.:	N/A	Auftragsdatum: Order date:	20.11.2019	
Auftraggeber: Client:	ALPS Electric Europe GmbH Schiesstr. 43, D-40549 DÜSSELDORF			
Prüfgegenstand: Test item:	Lykaner V (RC2)			
Bezeichnung / Typ-Nr.: Identification / Type No.:	LYK194A			
Auftrags-Inhalt: Order content:	Prüfung der Funkparameter nach FCC Test of radio parameters acc. to FCC			
Prüfgrundlage: Test specification:	Vollprüfung / Complete test FCC CFR 47 Part 15 Subpart C - §15.247			
Wareneingangsdatum: Date of receipt:	15.10.2019			
Prüfmuster-Nr.: Test sample No.:	A000245489-001 A000250657-001			
Prüfzeitraum: Testing period:	03.12.2019 – 05.12.2019			
Ort der Prüfung: Place of testing:	Nürnberg Nuremberg			
Prüflaboratorium: Testing laboratory:	Wireless Test Center			
Prüfergebnis*: Test result*:	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
 21.04.2020 M.Sc. Alaa Bustati, SV		 21.04.2020 Dipl.-Ing. Melanie Bense, TL		
Datum Date	Name / Stellung Name / Position	Unterschrift Signature	Datum Date	Name / Stellung Name / Position
Sonstiges / Other:				
The test report 60321881-002 replaces the test report 60321881-001 (Test sample information updated) Der Prüfbericht 60321881-002 ersetzt den Prüfbericht 60321881-001 (Prüfmuster-information aktualisiert)				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend N/A = nicht anwendbar	4 = ausreichend N/T = nicht getestet
Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory N/A = not applicable	4 = sufficient N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark				

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LISTE DER VERWENDETEN PRÜFMITTEL
LIST OF USED TEST EQUIPMENT

Prüfmittel <i>Test equipment</i>		Prüfmittel-Nr. / ID-Nr. <i>Equipment No. / ID-No.</i>	Letzte Kalibrierung <i>Last calibration</i>	Nächste Kalibrierung <i>Next calibration</i>
Test System TS8997: Power Meter: OSP-B157 Spectrum Analyzer: FSV-30 Signal Generator: SMB100A Vector Signal Generator: SMBV100A	Rohde & Schwarz	2728871	07.2019	07.2021
Fully Anechoic Room	Albatross Projects GmbH	2959749	10.2018	10.2021
Antenna HF907	Rohde & Schwarz	2856263	08.2018	08.2021
Pre-Amplifier BBV 9718	Schwarzbeck	2731378	10.2018	10.2020
Spectrum Analyser FSU26	Rohde & Schwarz	2819976	05.2019	05.2020
Antenna VULB 9168	Schwarzbeck	2728787	09.2019	09.2022
Receiver ESU 8	Rohde & Schwarz	2728844	12.2018	12.2019
Antenna HFH 2	Rohde & Schwarz	2728893	06.2018	06.2021
Semi-Anechoic Chamber 30-1000 MHz	Siemens	2729645	08.2018	07.2020

LISTE DER VERWENDETEN PRÜFSOFTWARE
LIST OF USED TESTING SOFTWARE

Software	Manufacturer	Version
EMC 32	Rohde & Schwarz	10.50.00
BAT-EMC	NEXIO	3.19.1.10

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PRODUKTBESCHREIBUNG
PRODUCT DESCRIPTION

1	Test item	Lykaner V
2	Typ-No.	LYK194A
3	Description of DUT	The Lykaner devices are location trackers for assets in the logistic sector, using Sigfox as their main communication path
4	FCC-ID	2AT4V-LYKANER-V
5	Operating Frequency (MHz)	902.1375 – 904.3625 MHz, 920.1375 - 920.2625 MHz (Sigfox)
6	Channel Bandwidth	25 kHz
7	Number of Channels	54
8	Rated Voltage / Frequency	Battery 3.6 V / DC
9	Modulation	D-BPSK
10	Transmit Operating Modes	Mode 1: TX unmodulated CW mode Mode 2: TX modulated continuous streaming mode Mode 3: TX Frequency hopping mode
11	Antenna Type, Gain	Integrated 0 dBi
12	Used Samples	A000245489-001 → Radiated A000250657-001 → Conducted
13	Environment	Indoor/ Outdoor
14	Pictures of the DUT	

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**PRODUKTBESCHREIBUNG
PRODUCT DESCRIPTION**



Figure1: Front View



Figure 2: Back View

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1 Overview of Test cases and Applicability

Applied Standards: FCC CFR 47 Part 15 Subpart C - §15.247		
Section	Test Item	Result
15.247 (a)	20 dB Bandwidth and Number of Hopping Frequencies	Pass
15.247 (a)	Time of Occupancy	Pass
15.247 (a)	Carrier Frequency Separation	Pass
15.247 (b)	Maximum Output Power	Pass
15.247 (d)	Band Edge Measurement	Pass
15.247 (d)	Conducted Spurious Emission	Pass
15.205, 15.209	Radiated Spurious Emission	Pass
15.207	AC Power Conducted Emissions	N/A

N/A: Not Applicable

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2 General

2.1 Registration

The measurement facilities for conducted and radiated disturbance measurements of the TRLP have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules. Measurement data will be accepted in conjunction with applications for Certification under Parts 15 and 18 of the Commission's Rules.

FCC Registration Number: 939976

Bundesnetzagentur Registrierungsnummer: BNetzA-CAB-17/21-16

2.2 Applied standards

FCC CFR 47 Part 15 Subpart C - §15.247

Test Methods and Guidance Documents:

- ANSI C63.10:2013
- KDB 558074 D01 DTS Measurement Guidance v05
- KDB 662911 D01 Multiple Transmitter Output v02r01

3 Additional Information of EUT

3.1.1 Type of EUT

Stand-Alone Equipment

3.2 Special Accessories

A test jig was provided for DUT configurations.

3.3 Equipment Modifications

None

3.4 Software/Firmware of EUT

Used Software to configure the DUT with the required testing mode: STM32 ST-LINK Utility

Used Firmware: Lykaner5_SFXReady_release_3_07

3.5 System description

System:	Sigfox RC2
Frequency Range:	902 MHz to 928 MHz
Application:	Generic Use
Channel:	Hopping on 54 channels (902.1375 – 904.3625 MHz, 920.1375 - 920.2625 MHz)
Antenna:	Integrated
Modulation:	D-BPSK
System Type:	Frequency hopping system

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3.6 Test Modes

TX mode	Frequency	Configurations provided by the manufacturer
TX unmodulated CW	Lowest	RC4, Lowest Band, unmodulated
		Address048C
		0x080800E0AA55A1000000101000703
		0x080800F00001000000000
TX unmodulated CW	Middle	RC2, 54 Channels, Middle Band, unmodulated
		Address048C
		0x080800E0AA55A1000000101000703
		0x080800F000000000000000010
TX unmodulated CW	Highest	RC4, 54 Channels, Highest Band, unmodulated
		Address048C
		0x080800E0AA55A9AA0000104000703
		0x080800F000020000000000010
TX modulated continuous streaming	Lowest	RC2, Lowest Band, modulated
		Address048C
		0x080800E0AA55A1000000101020703
		0x080800F00001000000000
TX modulated continuous streaming	Middle	RC2, 54 Channels, Middle Band, modulated
		Address048C
		0x080800E0AA55A1000000101020703
		0x080800F000000000000000010
TX modulated continuous streaming	Highest	RC2, 54 Channels, Highest Band, modulated
		Address048C
		0x080800E0AA55A9AA0000104020703
		0x080800F00001000000005EB010
TX Frequency hopping	-	Frequency Hopping , 54 Channels
		Address048C
		0x080800E0AA55A8AA0000101000703
		0x080800F0000000000000EB020

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4 Test conditions

4.1 General

The DUT was tested standalone on the transmit test mode in normal test conditions.

4.2 Normal test conditions

Environmental condition	Parameter	Range
Temperature	°C	24
Relative humidity	%	45
Supply voltage	Volts/DC	3.6 V/DC

4.3 Antenna assemblies

Antenna connector is prepared so tests were done in conducted and radiated mode.

4.4 Measurement Uncertainty

Measurement uncertainties are calculated according to ETSI TR 100 028-1/-2 V.1.4.1 with a confidence level of 95% and with an expansion factor of k=2.

Measurement Uncertainty	
Frequency Error	0,748 %
Temperature	1 °C
Humidity	10 %
E.R.P.	4,05 dB
Carrier Power	1,46 dB
Conducted Spurious Emissions Test	4,00 dB
Radiated Spurious Emissions Test < 30MHz	1,6 dB
Radiated Spurious Emissions Test 30MHz – 1 GHz	4,5 dB
Radiated Spurious Emissions Test >1 GHz	5 dB
Adjacent Channel Power	1,43 dB

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5 Test Results in Detail

5.1 20 dB bandwidth and Number of hopping frequencies

5.1.1 Requirements / Limits

FCC Part 15, Subpart C, §15.247 (a) (1)

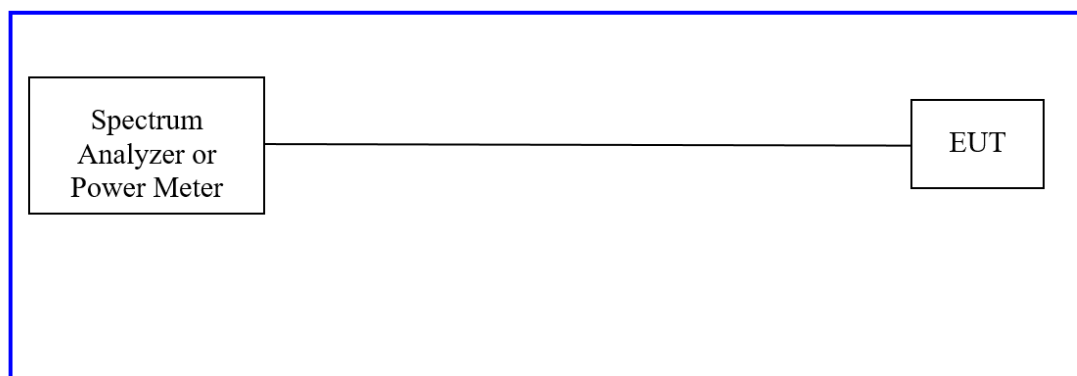
(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period;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

(ii) Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

5.1.2 Test Method

Conducted method was used to measure the 20 dB bandwidth and number of hopping frequencies. The EUT was connected to the spectrum analyzer via a coax cable with a known loss.



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5.1.3 Test Setup

5.1.3.1 20 dB Bandwidth

Operating mode	TX modulated continuous streaming mode
Test Condition	Normal conditions
EUT Configuration	The EUT was configured to transmit continuous modulated signal on the lowest, middle and highest frequencies

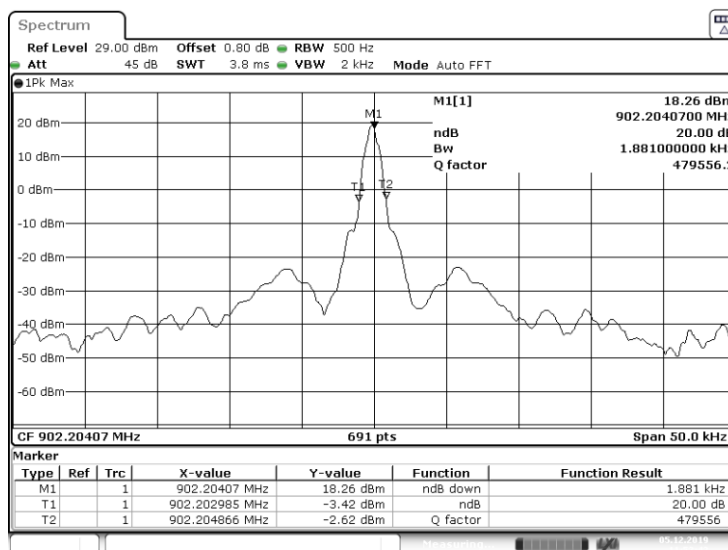
5.1.3.2 Number of hopping frequencies

Operating mode	TX Frequency hopping mode
Test Condition	Normal conditions
EUT Configuration	The EUT was configured to transmit in hopping mode

5.1.4 Test Results

5.1.4.1 20 dB Bandwidth

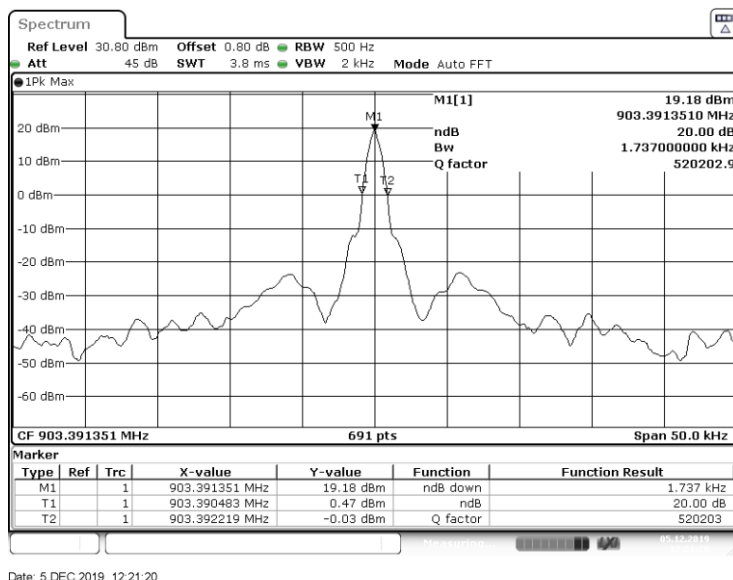
- Lowest Channel



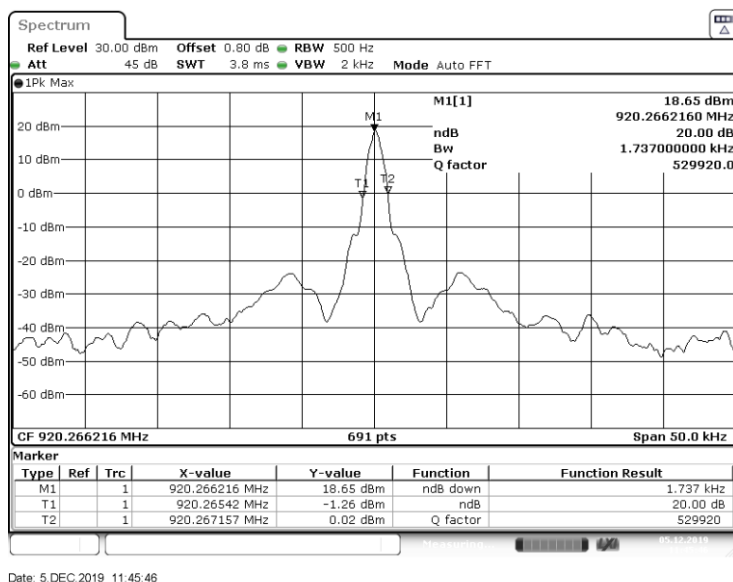
Date: 5 DEC 2019 11:52:43

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- Middle Channel



- Highest Channel



Frequency	20 dB Bandwidth (kHz)	Limit (kHz)	Test Result
Lowest	1.881	250	Pass
Middle	1.737		
Highest	1.737		

Final Test Result	Pass
-------------------	------

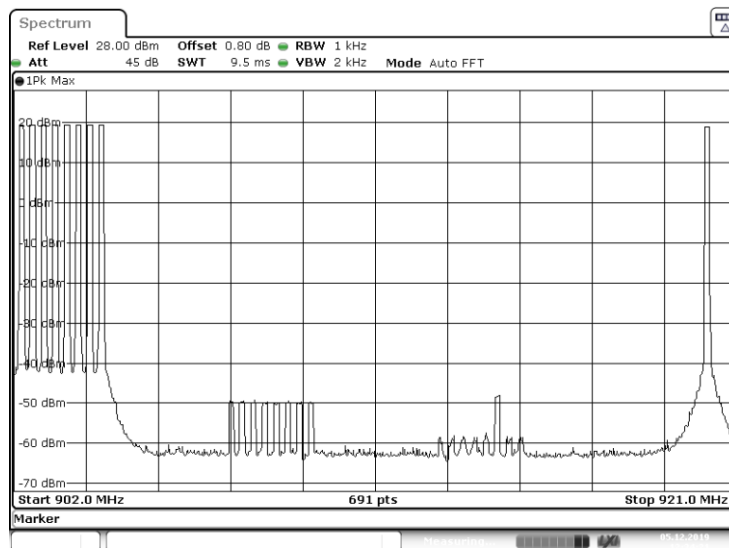
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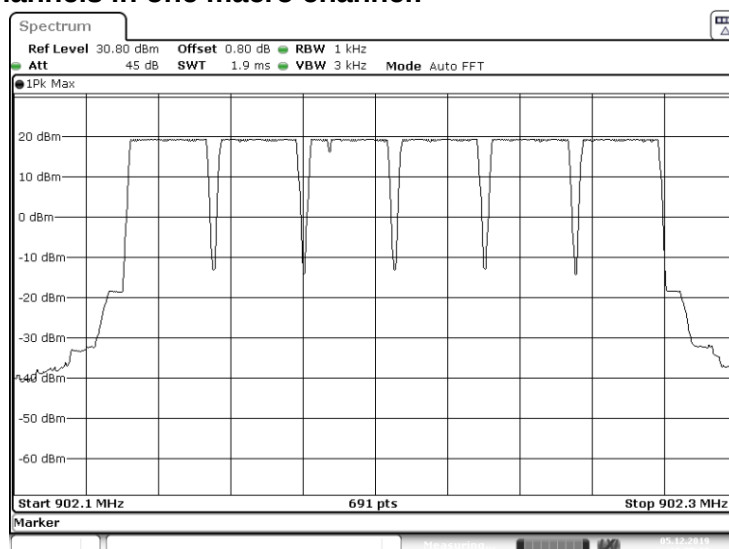
5.1.4.2 Number of hopping frequencies

Number of macro channels:



Date: 5 DEC 2019 12:34:21

Number of micro channels in one macro channel:



Date: 5 DEC 2019 13:55:28

Number of macro channels	Number of micro channels in one macro channel	Total number of hopping frequencies	Minimum requirement	Test Result
9	6	54	50 hopping frequencies	pass

Final Test Result

Pass

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5.2 Time of occupancy

5.2.1 Requirements / Limits

The requirements of the average time of occupancy on any frequency are specified in 4.1.1.

5.2.2 Test Method

Conducted method was used to measure the average time of occupancy. The EUT was connected to the spectrum analyzer via a coax cable with a known loss.

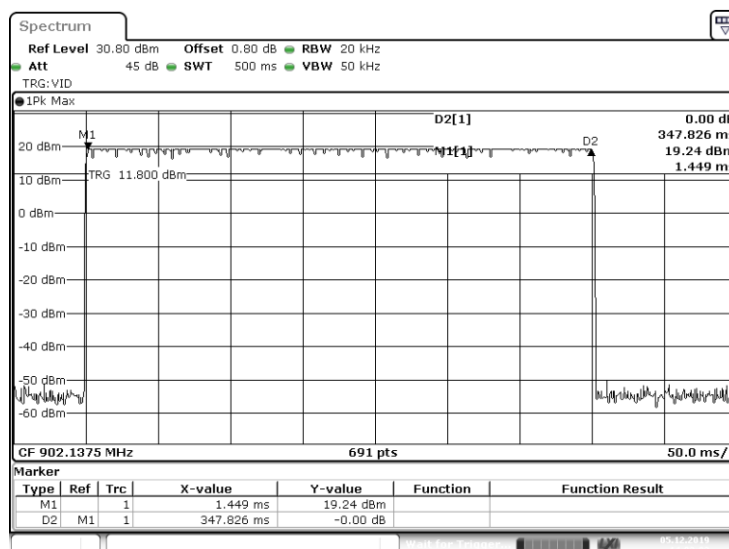
The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements (20 seconds).

5.2.3 Test Setup

Operating mode	TX Frequency hopping mode
Test Condition	Normal conditions
EUT Configuration	The EUT was configured to transmit in hopping mode

5.2.4 Test Results

Transmit time per hop:



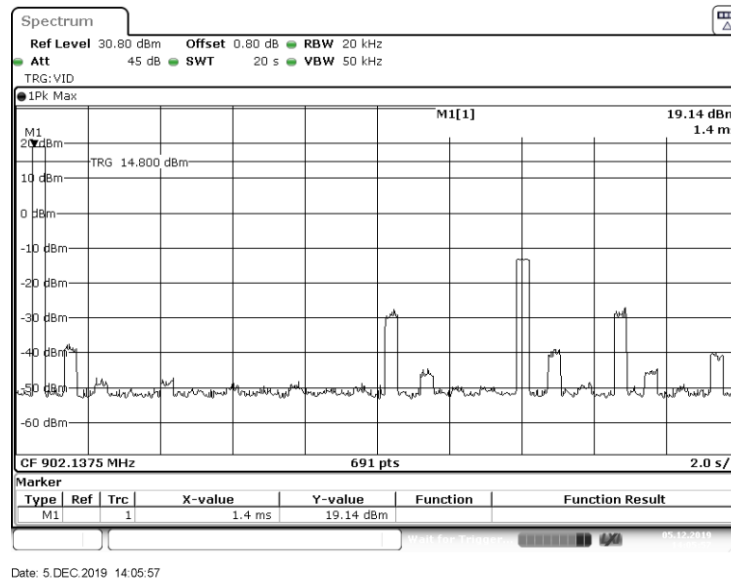
Date: 5 DEC 2019 14:02:02

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Number of hops in 20 seconds:



Transmit time per hop	Number of hops in 20 seconds	Average time of occupancy	Limit	Test Result
348.551 ms	1	347.826 ms	400 ms	pass

Final Test Result	Pass
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5.3 Carrier Frequency Separation

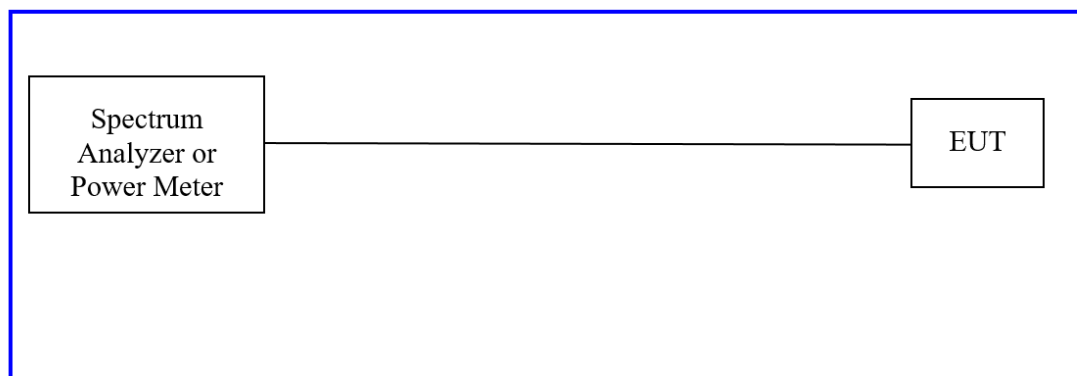
5.3.1 4.2.1 Requirements / Limits

FCC Part 15, Subpart C, §15.247 (a) (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.

5.3.2 Test Method

Conducted method was used to measure the minimum frequency separation. The EUT was connected to the spectrum analyzer via a coax cable with a known loss



5.3.3 Test Setup

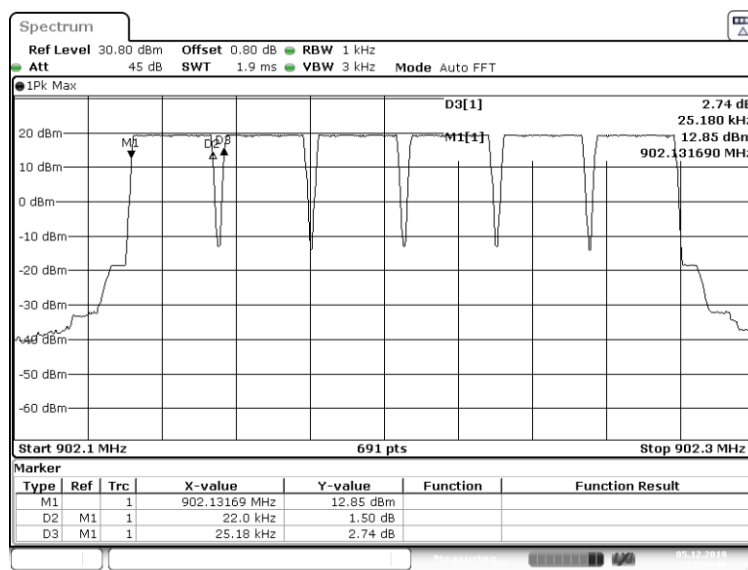
Operating mode	TX Frequency hopping mode
Test Condition	Normal conditions
EUT Configuration	The EUT was configured to transmit in hopping mode

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5.3.4 Test Results



Date: 5.DEC.2019 13:56:46

Channel Separation (kHz)	Minimum requirement (kHz)	Test Result
25.18	25	Pass

Final Test Result	Pass
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5.4 Maximum Output Power

5.4.1 Requirements / Limits

The maximum output power limit is expressed in terms of either maximum peak conducted output power or maximum conducted output power.

The maximum peak conducted output power is defined as the maximum power level measured with a peak detector using a filter with width and shape of which is sufficient to accept the full signal bandwidth.

The maximum conducted output power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

DTS devices:

FCC Part 15, Subpart C, §15.247 (b) (3)

For systems using digital modulation techniques in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands: 1 watt. Maximum conducted peak output power: 30 dBm (excluding antenna gain, if antennas with directional gains that do not exceed 6 dBi are used).

Frequency Hopping Systems:

FCC Part 15, Subpart C, §15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

FCC Part 15, Subpart C, §15.247 (b) (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.

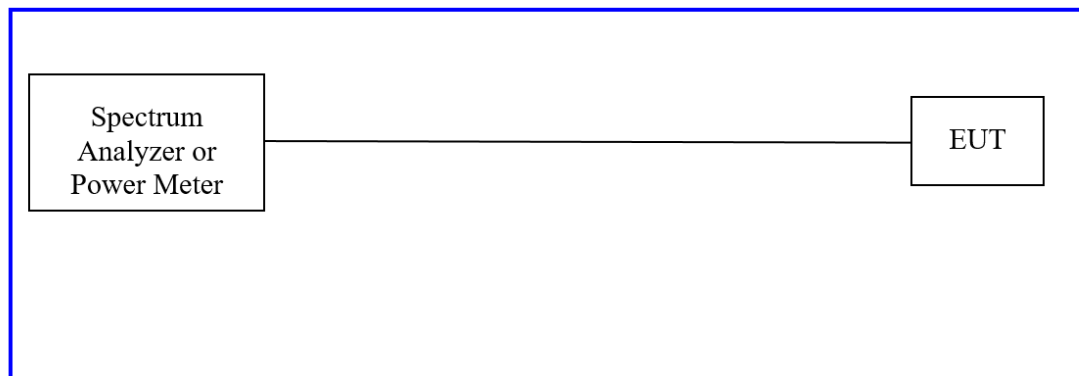
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5.4.2 Test Method

Conducted method was used to measure the maximum output power. The EUT was connected to the spectrum analyzer via a coax cable with a known loss.



5.4.3 Test Setup

Operating mode	TX modulated continuous streaming mode
Test Condition	Normal conditions
EUT Configuration	The EUT was configured to transmit continuous modulated signal on the lowest, middle and highest frequencies

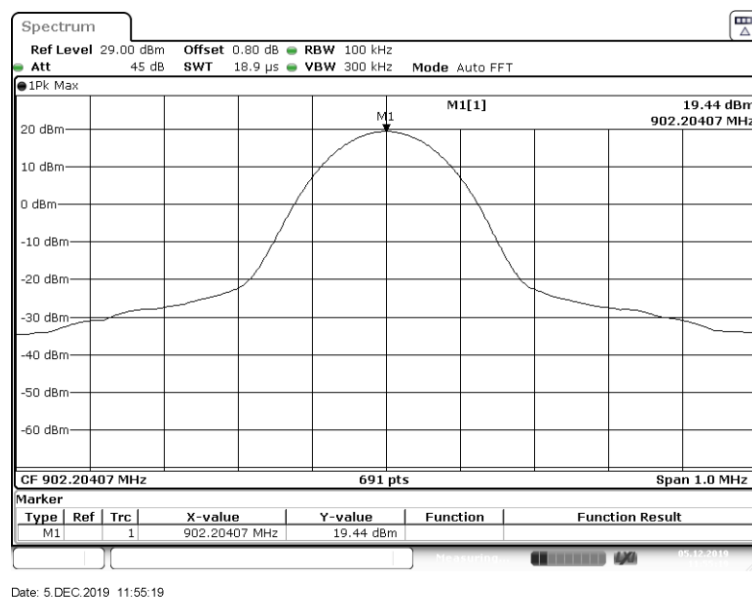
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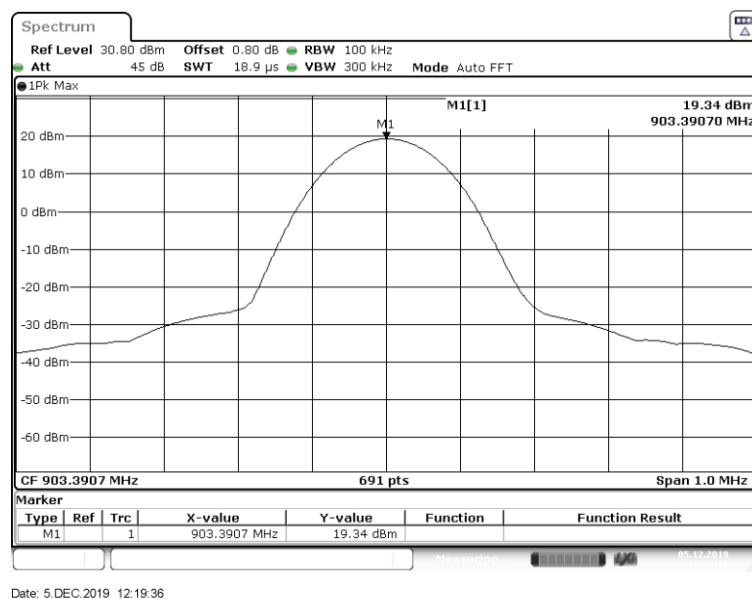
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5.4.4 Test Results

- Lowest Channel



- Middle Channel

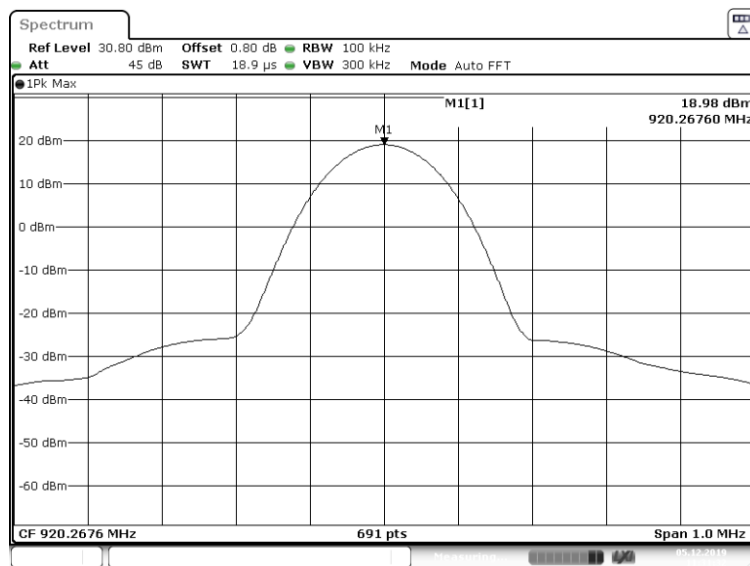


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- Highest Channel



Date: 5.DEC.2019 11:31:32

Frequency	Peak conducted output power (dBm)	Limit (dBm)	Margin (dB)	Test Result
Lowest	19.44	30	10.56	Pass
Middle	19.34		10.66	
Highest	18.98		11.02	

Final Test Result	Pass
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5.5 Conducted Spurious Emissions

5.5.1 Requirements / Limits

FCC Part 15, Subpart C, §15.247 (d)

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, provide the transmitter demonstrates compliance with the peak conducted power limits.

5.5.2 Test Method

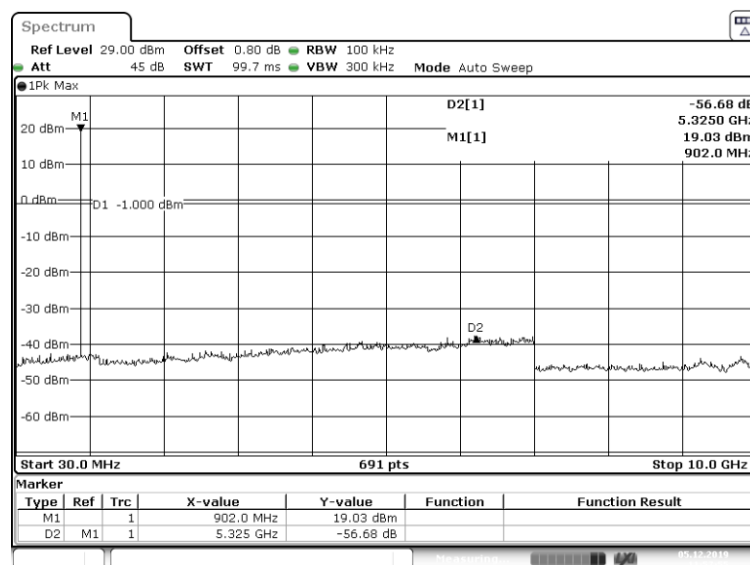
Conducted method was used to measure the conducted spurious emissions in frequency range (30 MHz to 10 GHz). The EUT was connected to the spectrum analyzer via a coax cable with a known loss.

5.5.3 Test Setup

Operating mode	TX modulated continuous streaming mode
Test Condition	Normal conditions
EUT Configuration	The EUT was configured to transmit continuous modulated signal on the lowest, middle and highest frequencies

5.5.4 Test results

- Lowest Channel

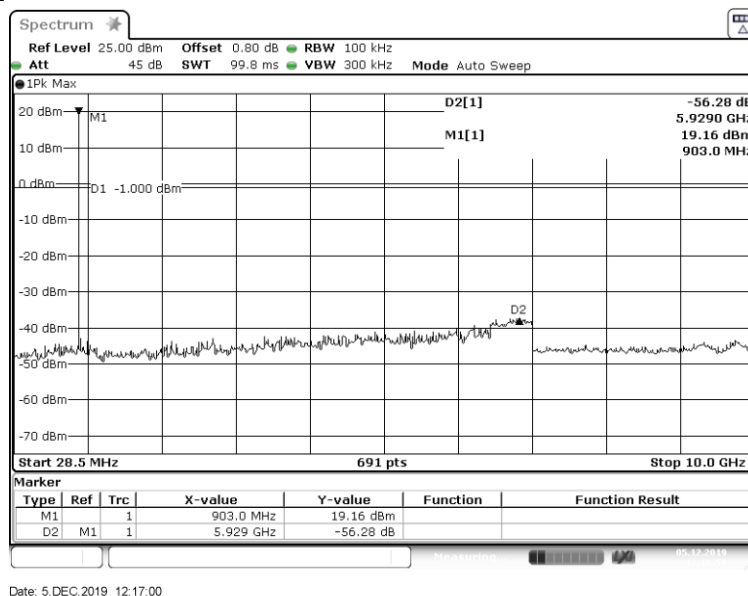


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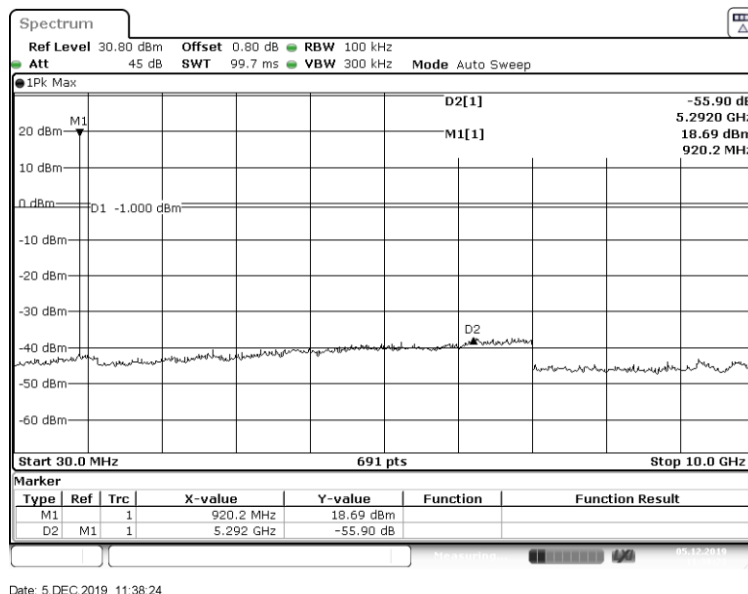
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- Middle Channel



- Highest Channel



Final Test Result

Pass

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5.6 Band Edge Measurement

5.6.1 Requirements / Limits

FCC Part 15, Subpart C, §15.247 (d)

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, provide the transmitter demonstrates compliance with the peak conducted power limits.

5.6.2 Test Method

Conducted method was used to perform the band edge measurements. The EUT was connected to the spectrum analyzer via a coax cable with a known loss. The measurements are done when DUT is configured to the lowest and highest channels, and in hopping mode as given by the manufacturer.

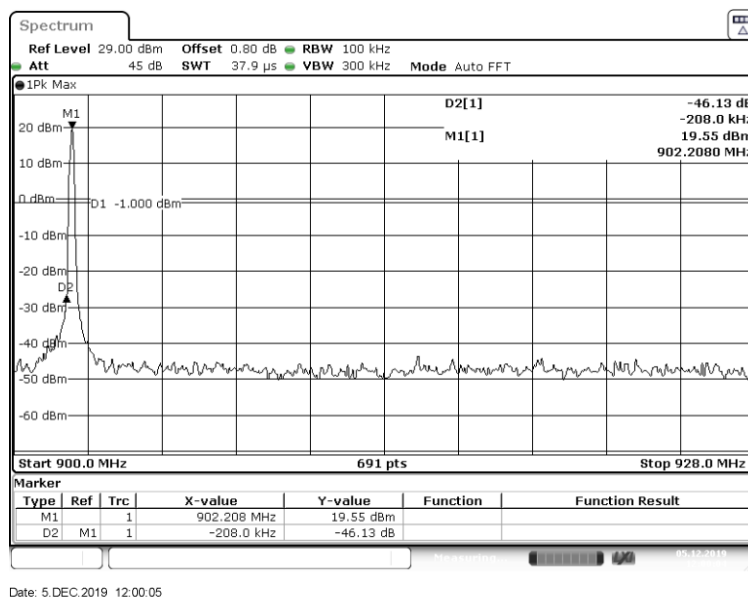
5.6.3 Test Setup

Operating mode	TX modulated continuous streaming mode
Test Condition	Normal conditions
EUT Configuration	The EUT was configured to transmit continuous modulated signal on the lowest and highest channels and to transmit in hopping mode

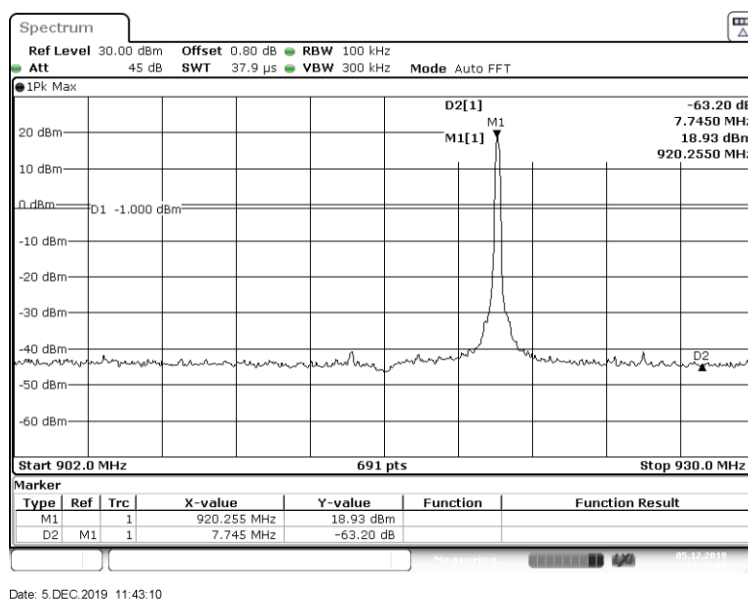
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5.6.4 Test results

- Lowest Channel



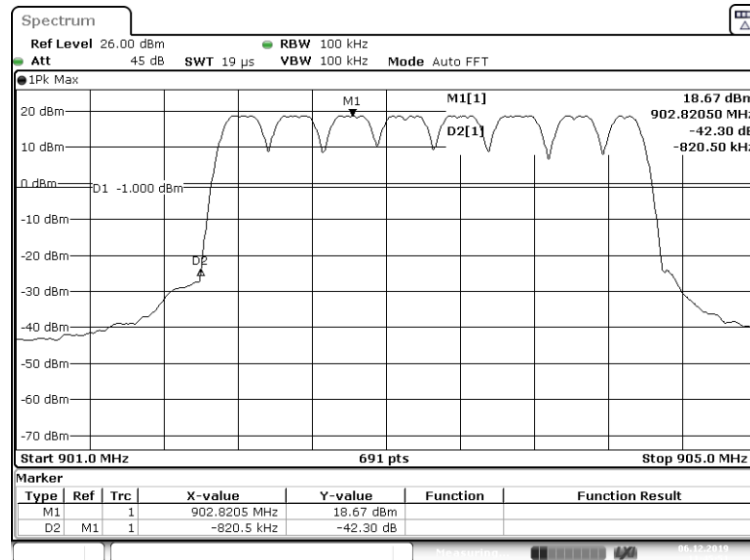
- Highest Channel



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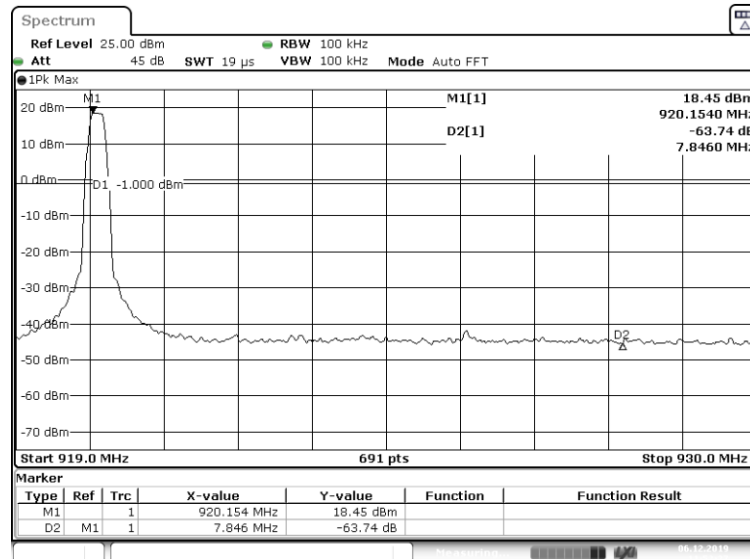
- Hopping Mode

Lower Edge:



Date: 6 DEC.2019 11:45:51

Higher Edge:



Date: 6 DEC.2019 11:52:28

Final Test Result

Pass

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5.7 Radiated Spurious Emissions

5.7.1 Requirements / Limits

Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmit mode. The emissions shall not exceed the values in FCC Part 15, Subpart C §15.205, §15.209, §15.247(d).

FCC Part 15, Subpart C, §15.247 (d)

... In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

FCC Part 15, Subpart C, §15.209, Radiated Emission Limits

Frequency [MHz]	Limit [$\mu\text{V/m}$]	Measurement distance [m]	Limits [$\text{dB}\mu\text{V/m}$]
0.009 – 0.49	2400/F(kHz)@300m	3	(48.5 – 13.8)@300m
0.49 – 1.705	24000/F(kHz)@30m	3	(33.8 – 23.0)@30m
1.705 – 30	30@30m	3	29.5@30m

The measured values are corrected with an inverse linear distance extrapolation factor (40 dB/decade) according FCC 15.31 (f)(2).

Frequency [MHz]	Limit [$\mu\text{V/m}$]	Measurement distance [m]	Limits [$\text{dB}\mu\text{V/m}$]
30 – 88	100@3m	3	40.0@3m
88 – 216	150@3m	3	43.5@3m
216 – 960	200@3m	3	46.0@3m
960 - 40000	500@3m	3	54.0@3m

§15.35(b) ..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor:

$$\text{Limit } [\text{dB}\mu\text{V/m}] = 20 \log (\text{Limit } [\mu\text{V/m}] / 1\mu\text{V/m})$$

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5.7.2 Test Method

5.7.2.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. Preliminary emission profile testing was performed inside the anechoic chamber. The receiving antenna was placed at a distance of 3m for all measurements. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT. The different measurement setup for each frequency range are shown below.

9 kHz - 30 MHz

Following Measurement Setup is used:

Test Site	Semi-anechoic chamber
Receiving Antenna	Loop antenna (HFH 2)
Receiving Antenna Height	1 m
Receiving Antenna Polarisation	Parallel – Perpendicular
EUT Table	1.0m x 1.5m non-conductive table 80cm above the floor
EUT Turn Table Step Size	22.5°
Receiver Configurations	Average and peak detectors
	RBW: 200Hz (9 - 150 kHz) and 9 kHz (150 kHz – 30 MHz)
	Step Size: 50Hz (9-150kHz) and 2.25kHz (150k-30MHz)
	Sweep Time: 100ms (FFT)

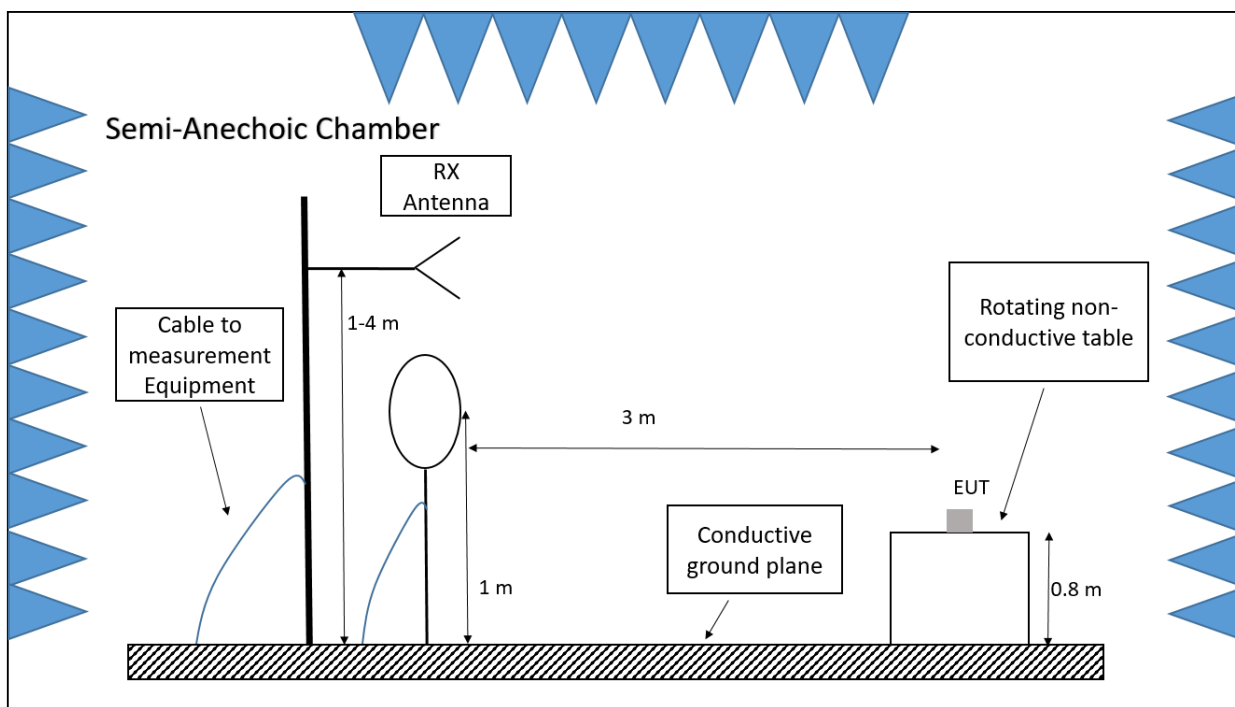
30 MHz - 1 GHz

Following Measurement Setup is used:

Test Site	Semi-anechoic chamber
Receiving Antenna	Hybrid Antenna VULB 9168
Receiving Antenna height	Varied (1m to 4 m, step size 1m)
Receiving Antenna Polarisation	Horizontal– Vertical
EUT Table	1.0m x 1.5m non-conductive table 80cm above the floor
EUT Turn Table Step Size	45°
Receiver Configurations	Peak detector
	RBW :120 kHz
	Step Size: 30kHz (30-1000MHz)
	Sweep Time : 100 ms (FFT)

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For Measurements below 1 GHz, the EUT was positioned as shown in the setup photograph:



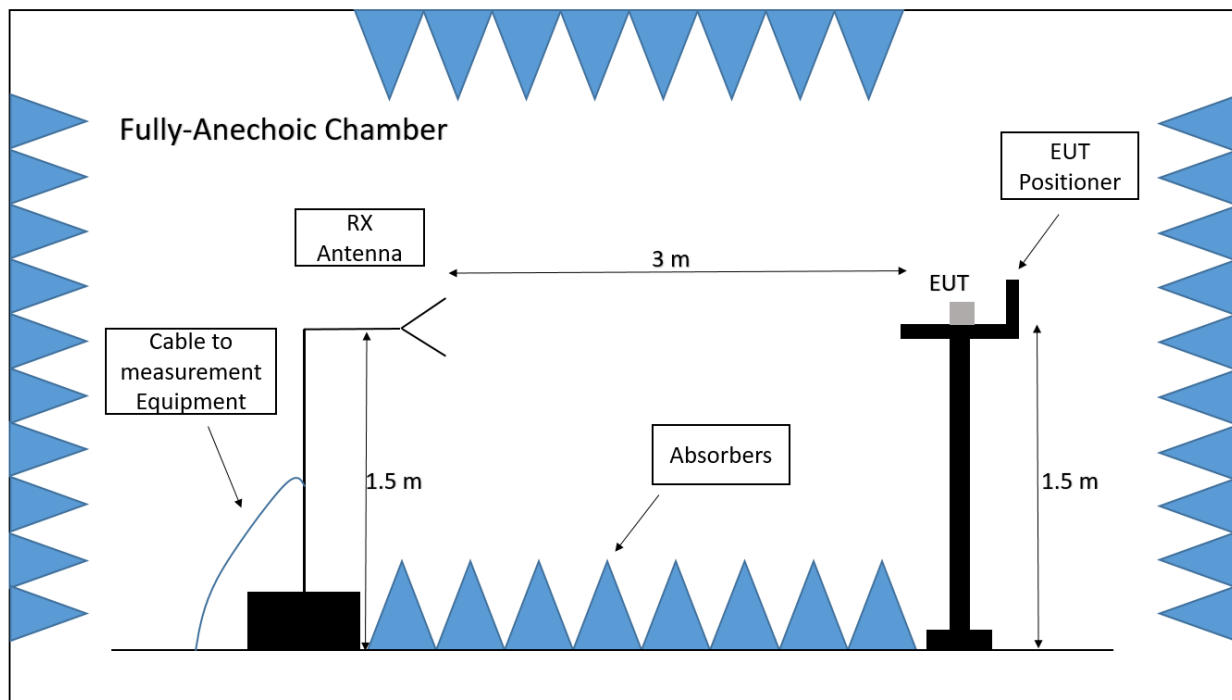
1 GHz - 10 GHz

Following Measurement Setup is used:

Test Site	Fully-anechoic chamber
Receiving Antenna	Horn Antenna HF907 (1-10 GHz)
Receiving Antenna Height	1.5 m
Receiving Antenna Polarisation	Horizontal– Vertical
EUT Positioner	40 cm x 60 cm non-conductive positioner 1.5 m above the floor / Step size,elevation angle 45°
EUT Turn Table Step Size	45°
Spectrum Analyser	Average and peak detectors
	RBW: 1 MHz
	Sweep Time : 100 ms

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For Measurements over 1 GHz, the EUT was positioned as shown in the setup photograph:



5.7.2.2 Final Test

The placement of EUT and cables were the same as for preliminary testing. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, then the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked. For the measurements in the frequency range 30 MHz to 1 GHz for each measured frequency the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. For measurement above 1 GHz the turntable and positioner step sizes were set to a range of 22° and the antenna height is fixed.

For the measurements in the frequency ranges (90-110kHz, 490 kHz-1 GHz) quasi-peak detector is used, while average and peak detectors are used in other ranges.

Final testing was performed on an SVSWR compliant test site.

The final average electric field value (E_{final}) is calculated in the final measurement table using the following equation:

$$E_{final} = \text{RawRec} + \text{Corr.}$$

While

$$\text{Corr.} = \text{Trd. Corr.} + \text{Sig Path} + \text{Preamp}$$

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5.7.3 Test Setup

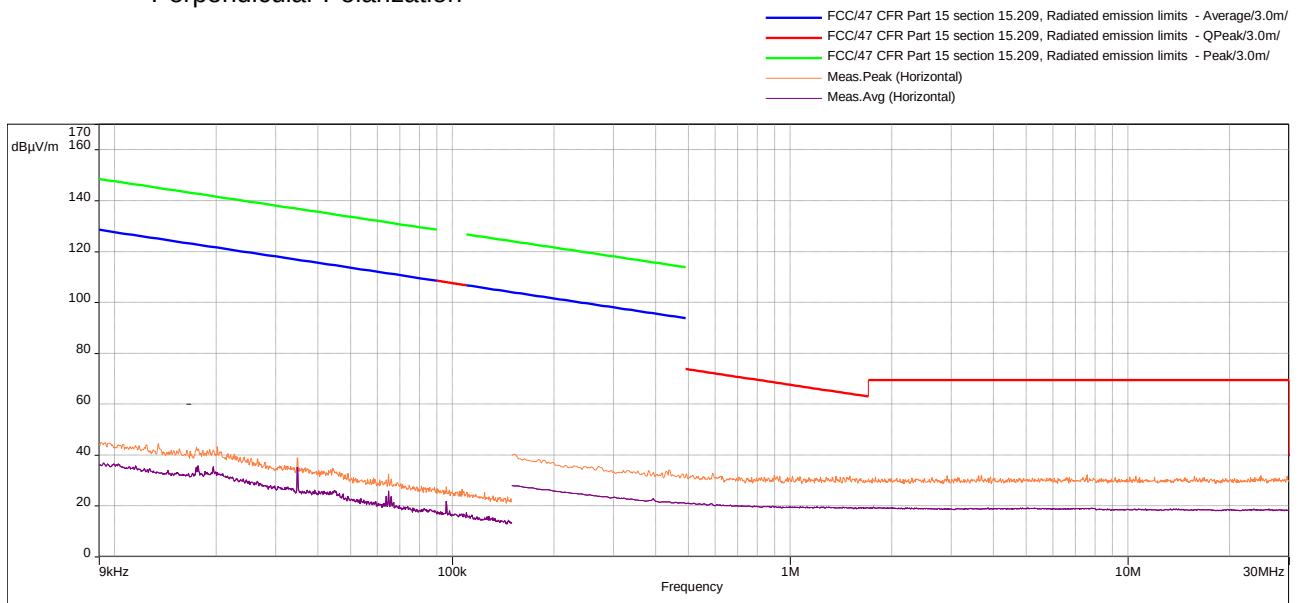
Operating mode	TX modulated continuous streaming mode
Test Condition	Normal conditions
EUT Configuration	The EUT was configured to transmit continuous modulated signal on the lowest, middle and highest frequencies

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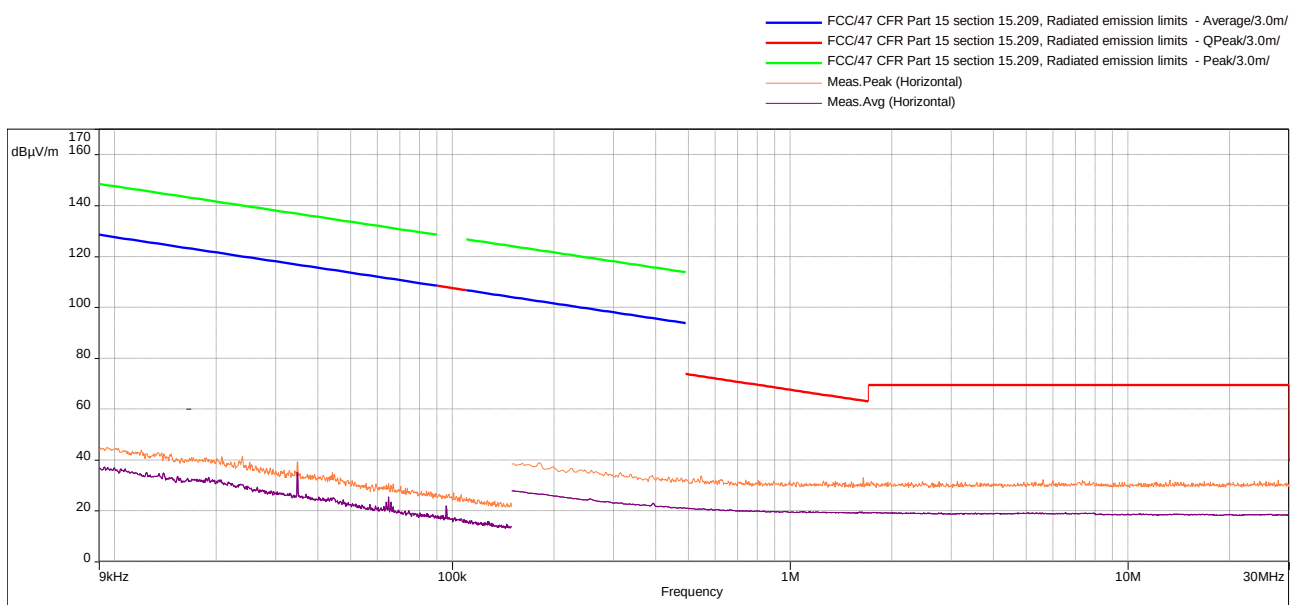
5.7.4 Test Results

– 9kHz to 30 MHz, lowest channel

• Perpendicular Polarization



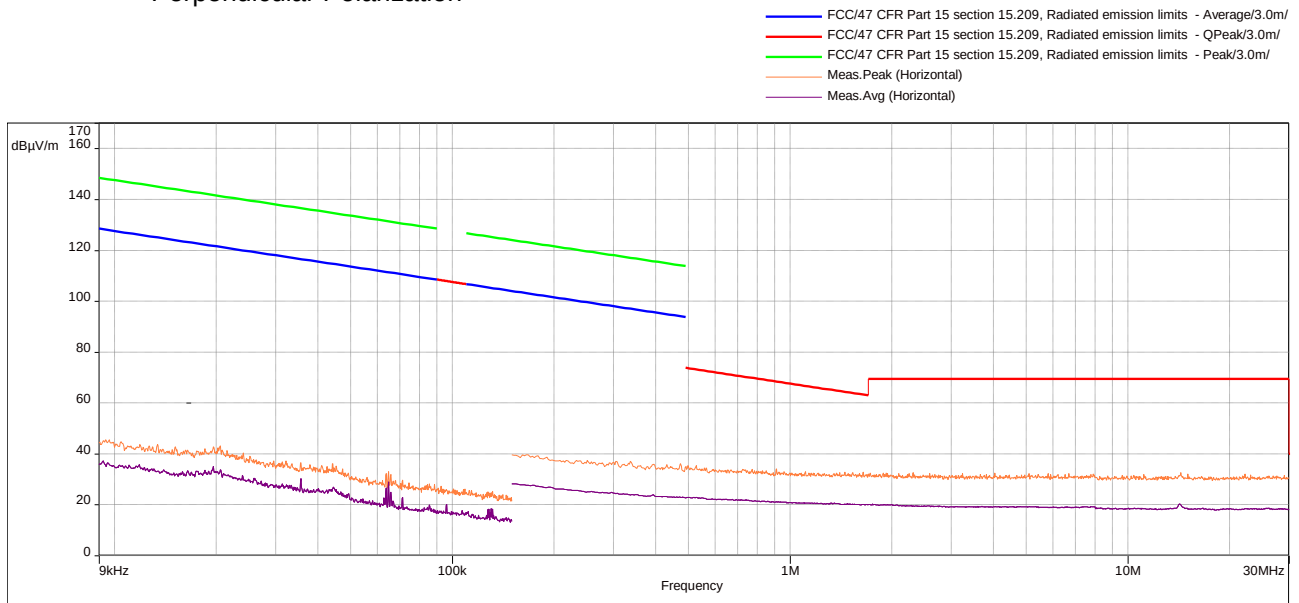
• Parallel Polarization



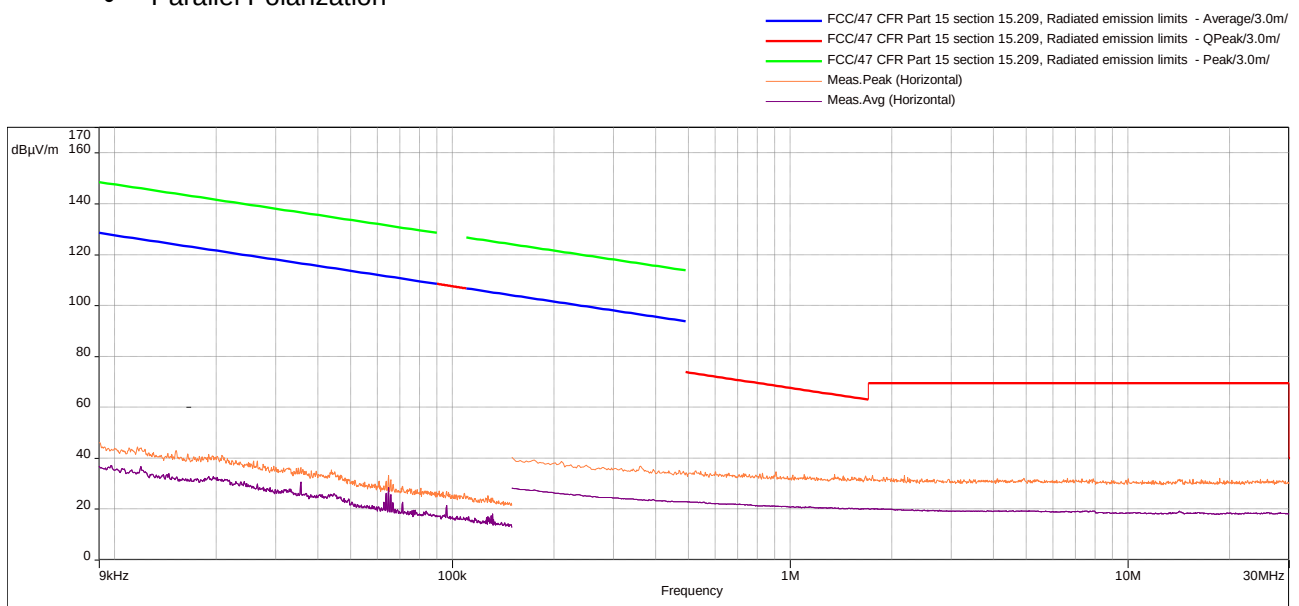
MESSDOKUMENTATION TEST DOCUMENTATION

– 9kHz to 30 MHz, middle channel

• Perpendicular Polarization



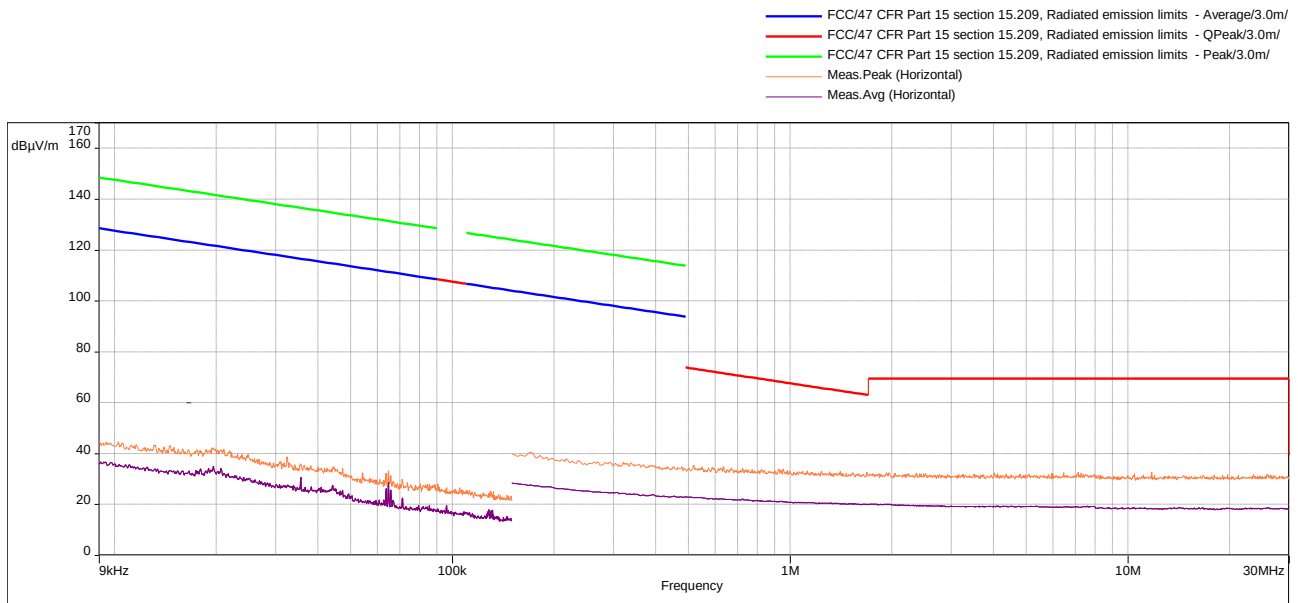
• Parallel Polarization



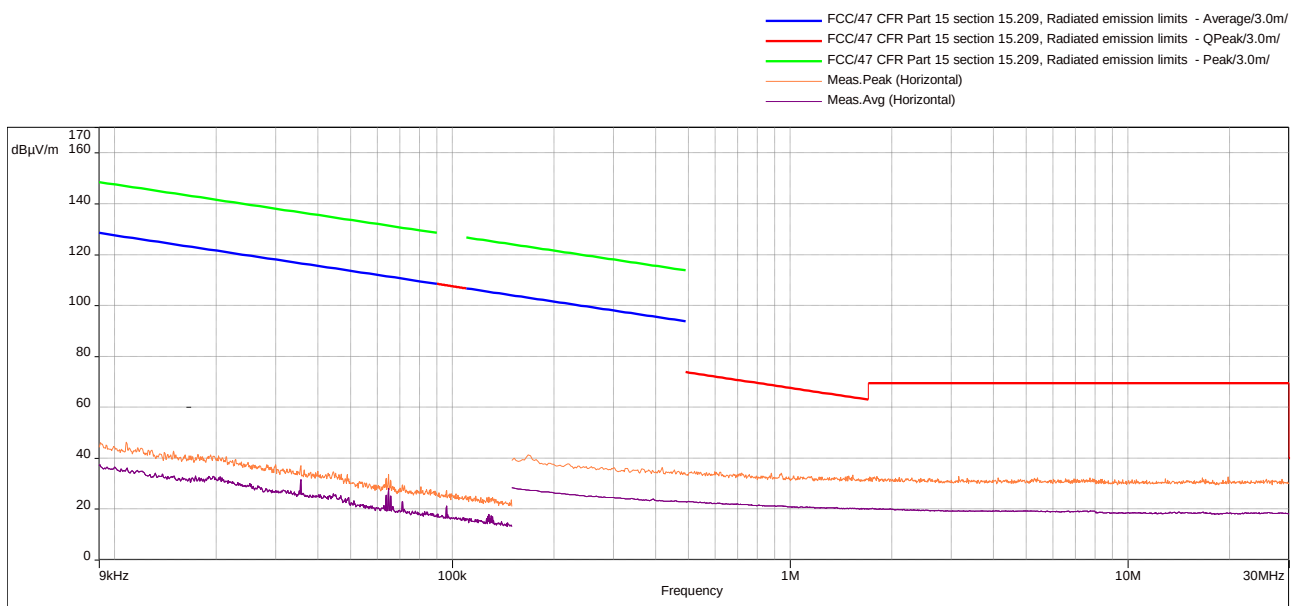
MESSDOKUMENTATION TEST DOCUMENTATION

– 9kHz to 30 MHz, highest channel

• Perpendicular Polarization



• Parallel Polarization



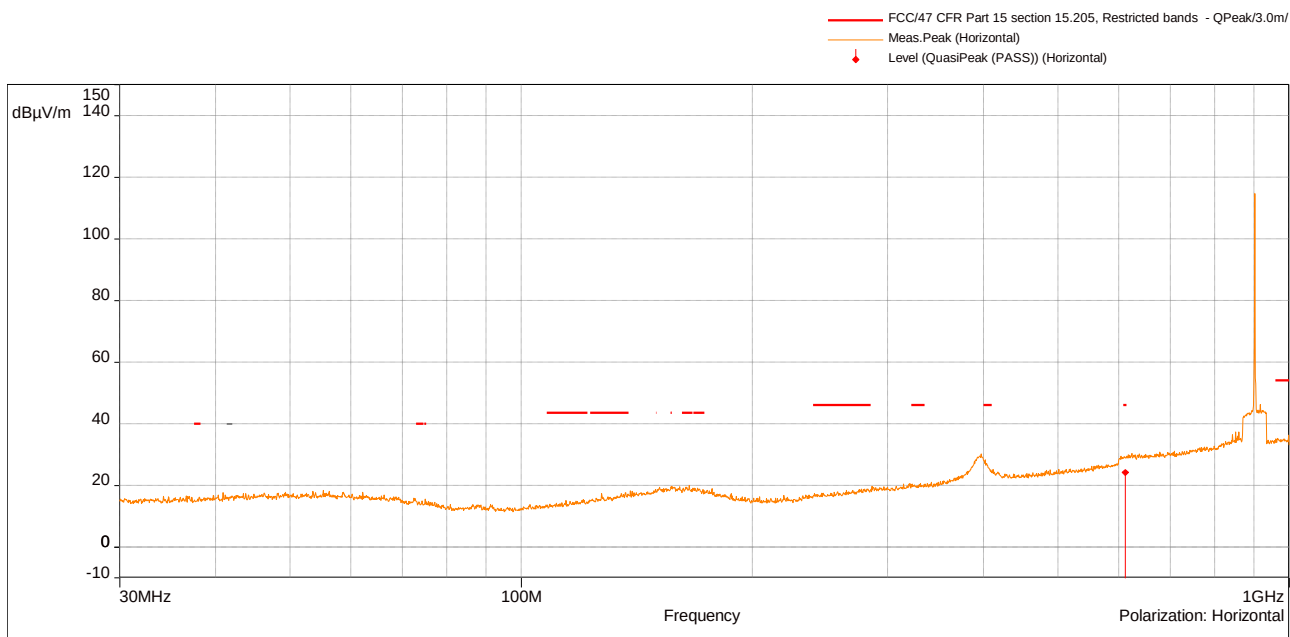
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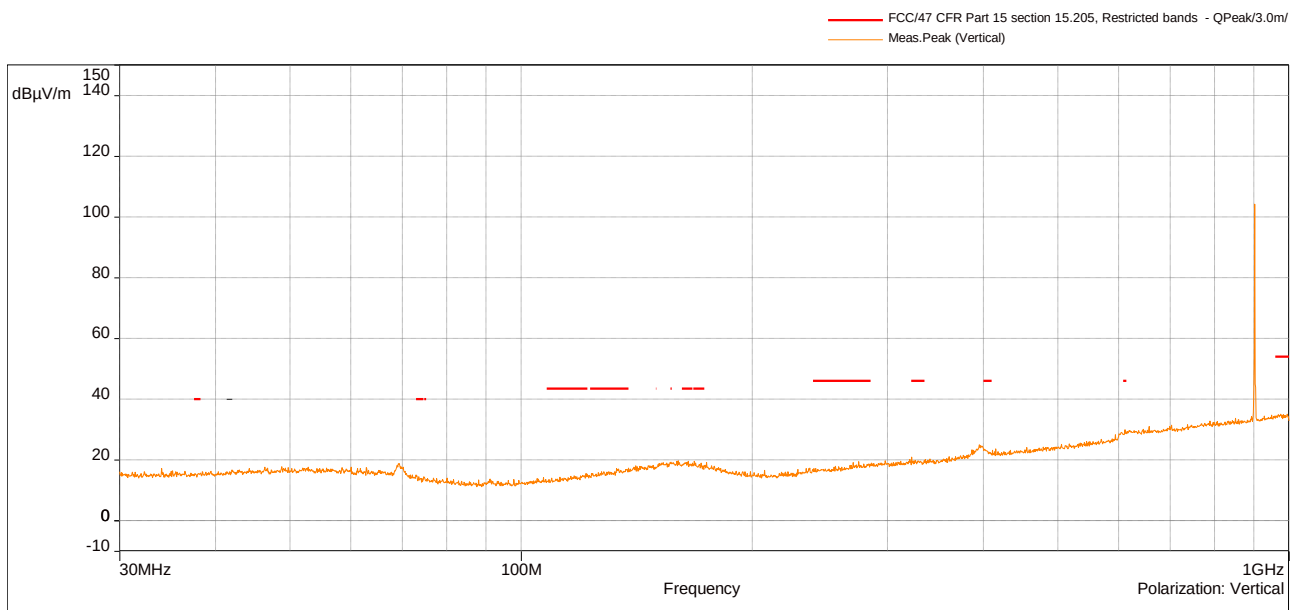
MESSDOKUMENTATION TEST DOCUMENTATION

– 30 MHz – 1 GHz , lowest channel

• Horizontal Polarization



• Vertical Polarization

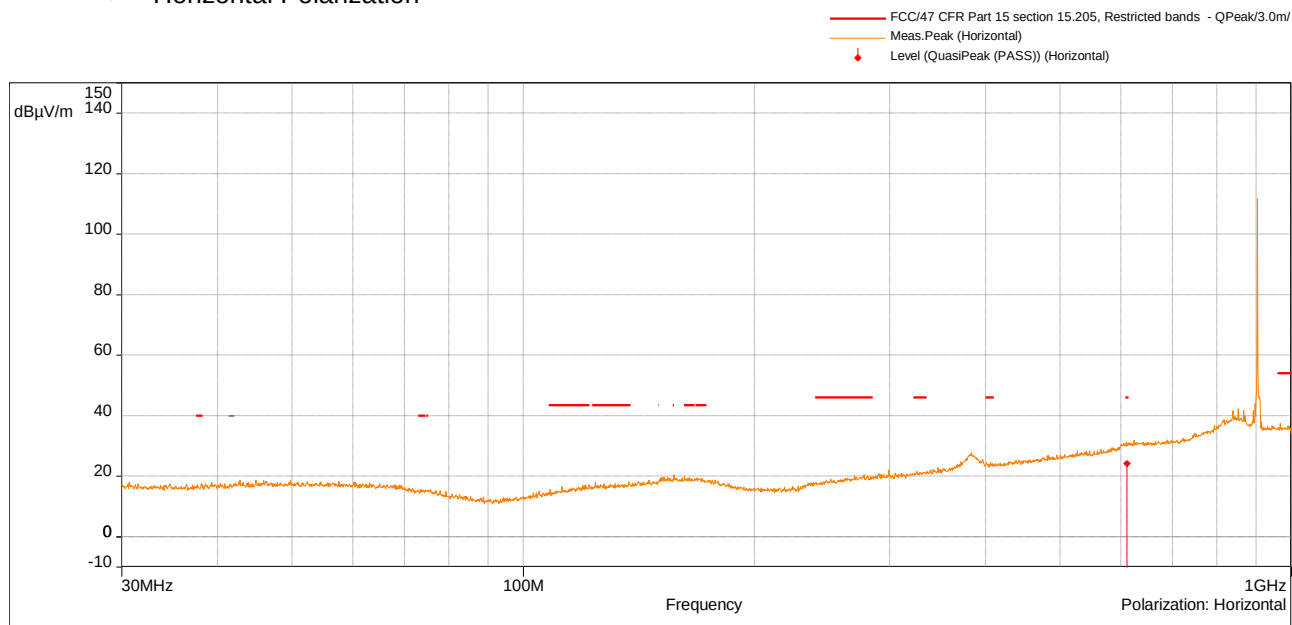


Frequency (MHz)	SR	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Pol.	Meas. Time (s)	Correction (dB)
611.67	1	24.22	46.00	21.78	259.9	4.00	Horizontal	1.00	23.83

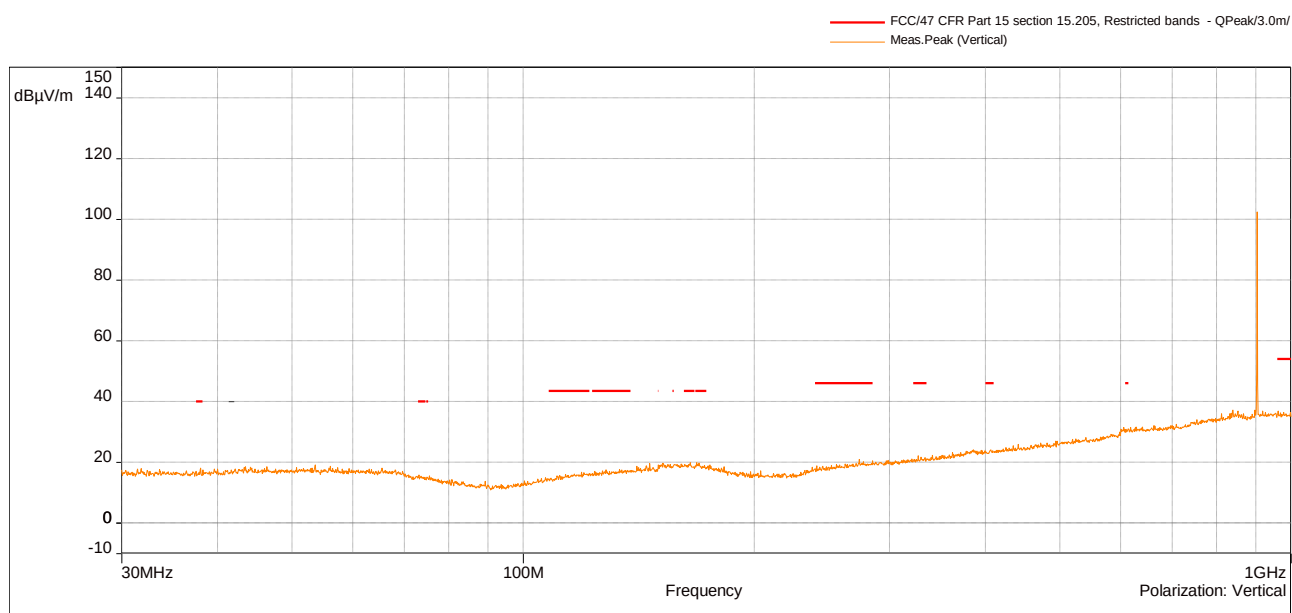
MESSDOKUMENTATION TEST DOCUMENTATION

– 30 MHz – 1 GHz , middle channel

• Horizontal Polarization



• Vertical Polarization



Frequency (MHz)	SR	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Pol.	Meas. Time (s)	Correction (dB)
610.86	1	24.23	46.00	21.77	213.70	1.58	Horizontal	1.00	23.83

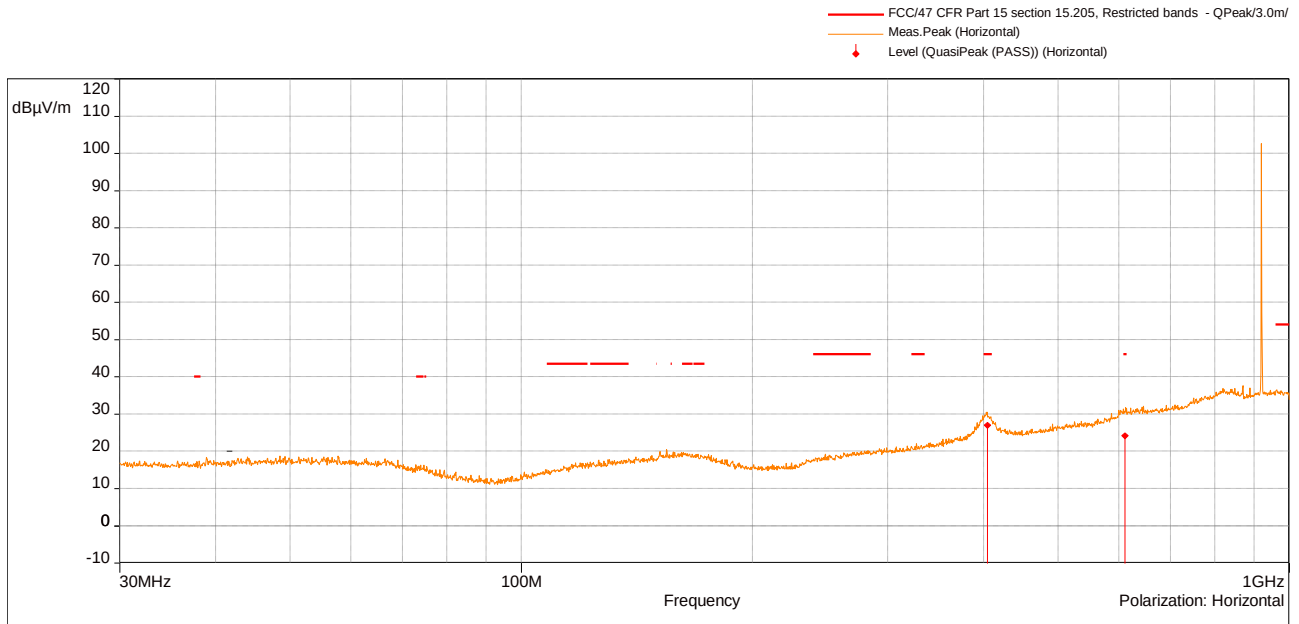
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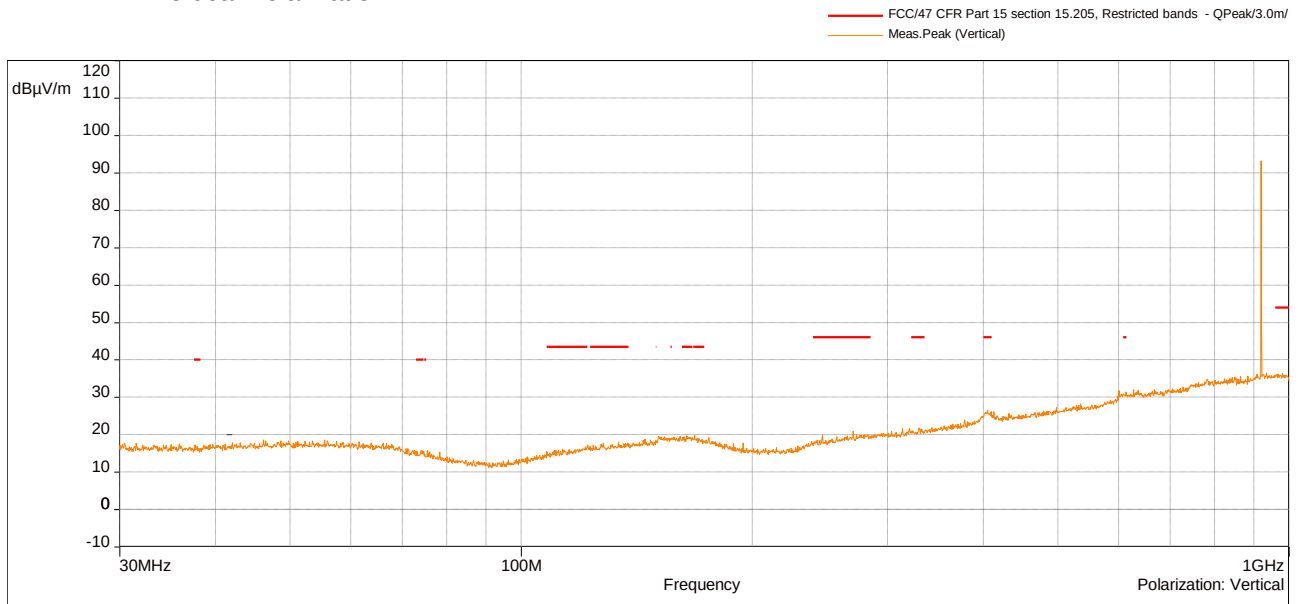
MESSDOKUMENTATION TEST DOCUMENTATION

– 30 MHz – 1 GHz , highest channel

• Horizontal Polarization



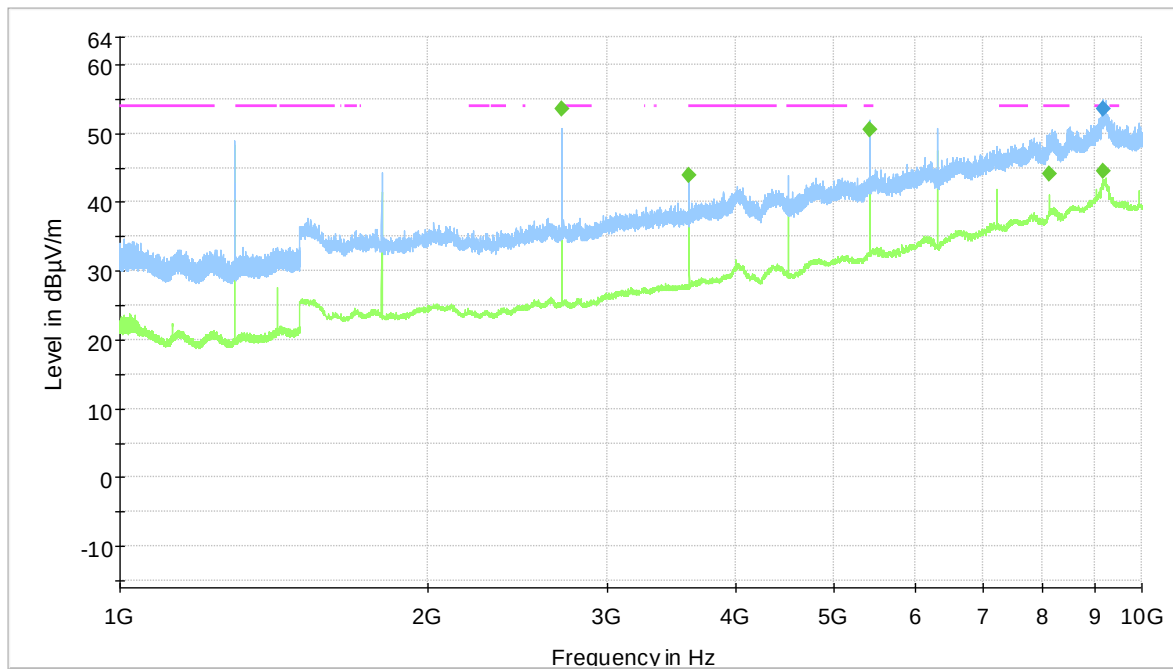
• Vertical Polarization



Frequency (MHz)	SR	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Pol.	Meas. Time (s)	Correction (dB)
404.34	1	27.06	46.00	18.94	137.70	1.00	Horizontal	1.00	18.61
610.89	1	24.18	46.00	21.82	14.40	1.57	Horizontal	1.00	23.83

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– 1-10 GHz , lowest channel

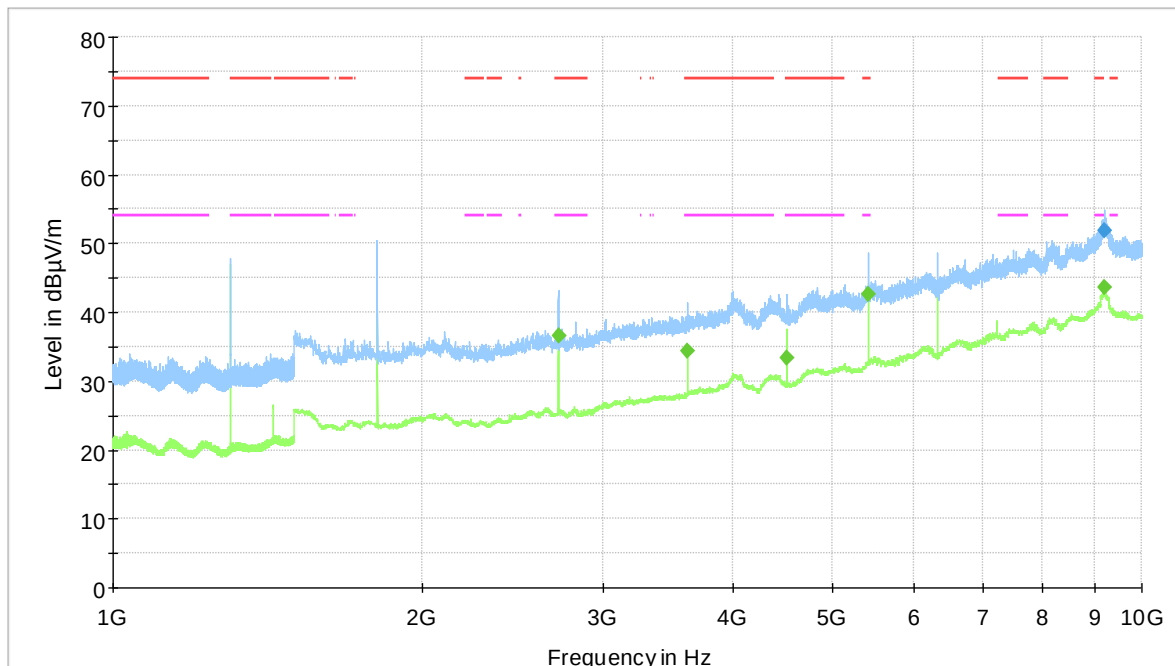


— Preview Result 2-AVG
— FCC_15C_15.209_Radiated_Emissions_Peak
◆ Final_Result PK+
 — Preview Result 1-PK+
- - - FCC_15C_15.209_Radiated_Emissions_Avg
◆ Final_Result AVG

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBμV)
2706.291667	---	53.55	54.00	0.45	10.0	1000.000	150.0	H	259.0	113.0	-2.4	-32.1	0.0	29.7	56.0
3608.354167	---	43.88	54.00	10.12	10.0	1000.000	150.0	V	156.0	344.0	0.8	-31.2	0.0	32.0	43.1
5412.479167	---	50.59	54.00	3.41	10.0	1000.000	150.0	V	143.0	49.0	6.6	-28.0	0.0	34.6	44.0
8119.020833	---	44.12	54.00	9.88	10.0	1000.000	150.0	H	219.0	51.0	13.0	-23.4	0.0	36.4	31.1
9173.375000	53.52	---	74.00	20.48	10.0	1000.000	150.0	V	338.0	113.0	17.9	-18.9	0.0	36.7	35.7
9176.562500	---	44.48	54.00	9.52	10.0	1000.000	150.0	V	338.0	109.0	17.9	-18.8	0.0	36.7	26.6

MESSDOKUMENTATION TEST DOCUMENTATION

– 1-10 GHz , middle channel

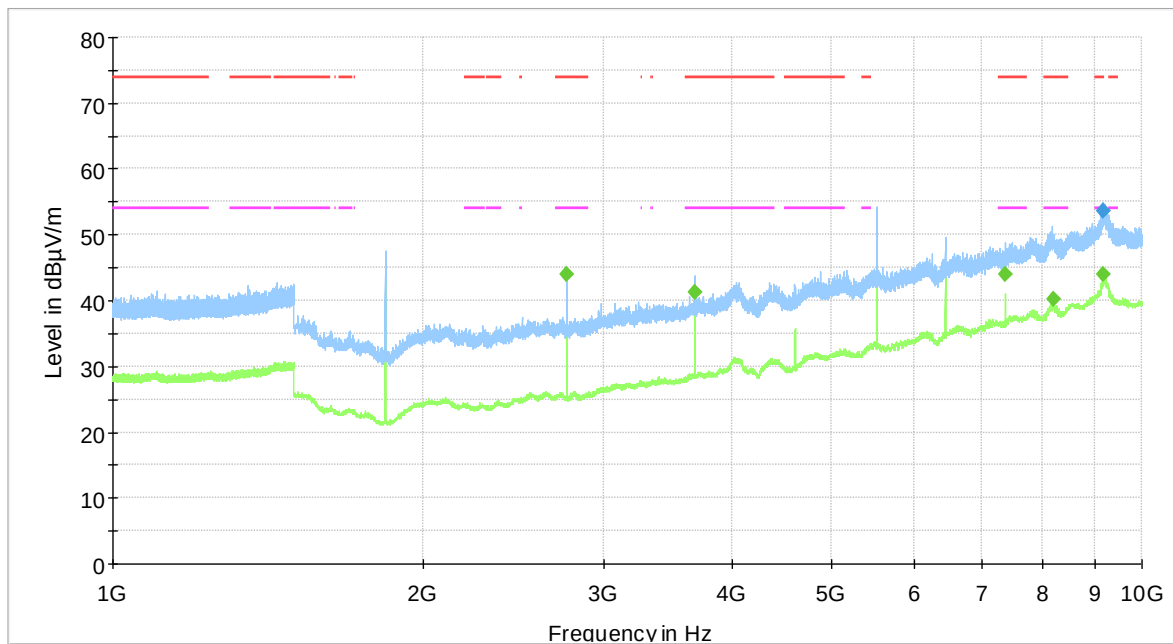


— Preview Result 2-AVG
— FCC_15C_15.209_Radiated_Emissions_Peak
— Preview Result 1-PK+
— FCC_15C_15.209_Radiated_Emissions_Avg
◆ Final_Result PK+
◆ Final_Result AVG

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
2710.000000	---	36.65	54.00	17.35	10.0	1000.000	150.0	V	195.0	330.0	-2.4	-32.1	0.0	29.6	39.1
3613.375000	---	34.33	54.00	19.67	10.0	1000.000	150.0	H	22.0	314.0	0.9	-31.2	0.0	32.1	33.4
4516.750000	---	33.39	54.00	20.61	10.0	1000.000	150.0	V	308.0	34.0	3.4	-30.1	0.0	33.5	30.0
5420.125000	---	42.57	54.00	11.43	10.0	1000.000	150.0	V	255.0	45.0	6.4	-28.2	0.0	34.6	36.2
9193.125000	51.95	---	74.00	22.05	10.0	1000.000	150.0	H	112.0	67.0	17.4	-19.3	0.0	36.8	34.5
9193.812500	---	43.71	54.00	10.29	10.0	1000.000	150.0	V	157.0	276.0	17.4	-19.3	0.0	36.8	26.3

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– 1-10 GHz , highest channel



— Preview Result 2-AVG
* MaxPeak-PK+
— FCC_15C_15.209_Radiated_Emissions_Peak
◆ Final_Result PK+

— Preview Result 1-PK+ Average-AVG
* Average-AVG
— FCC_15C_15.209_Radiated_Emissions_Avg
◆ Final_Result AVG

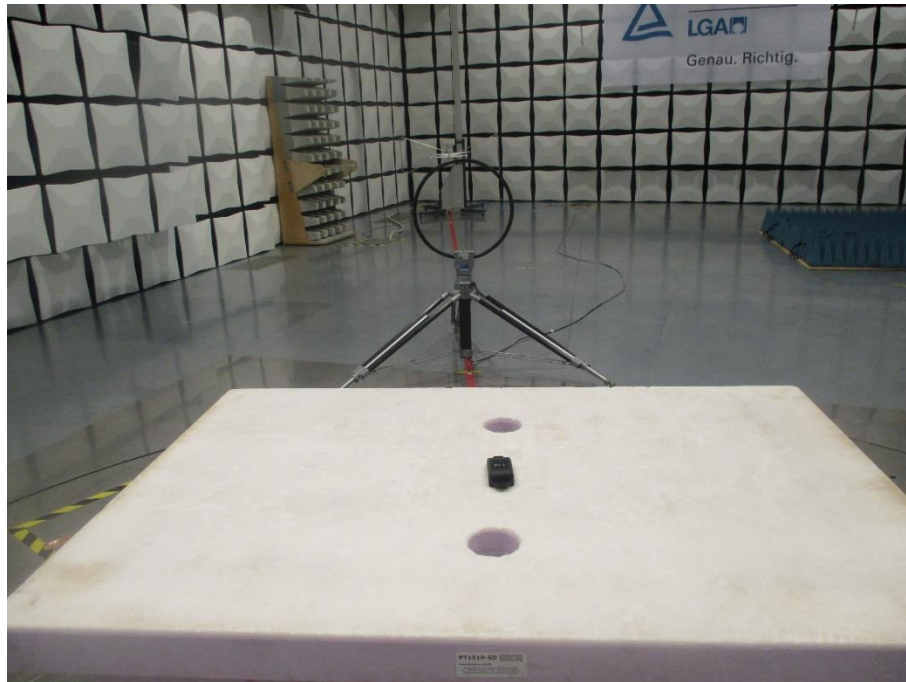
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
2760.833333	---	44.06	54.00	9.94	10.0	1000.000	150.0	H	241.0	104.0	-2.7	-32.1	0.0	29.5	46.7
3680.958333	---	41.16	54.00	12.84	10.0	1000.000	150.0	V	84.0	76.0	1.4	-31.0	0.0	32.4	39.8
7362.166667	---	43.94	54.00	10.06	10.0	1000.000	150.0	V	112.0	87.0	11.0	-24.6	0.0	35.6	32.9
8197.645833	---	40.21	54.00	13.79	10.0	1000.000	150.0	H	222.0	87.0	13.2	-23.3	0.0	36.6	27.0
9171.958333	53.53	---	74.00	20.47	10.0	1000.000	150.0	H	112.0	113.0	17.8	-18.9	0.0	36.7	35.7
9174.083333	---	43.94	54.00	10.06	10.0	1000.000	150.0	H	49.0	30.0	17.9	-18.9	0.0	36.7	26.1

Final Test Result

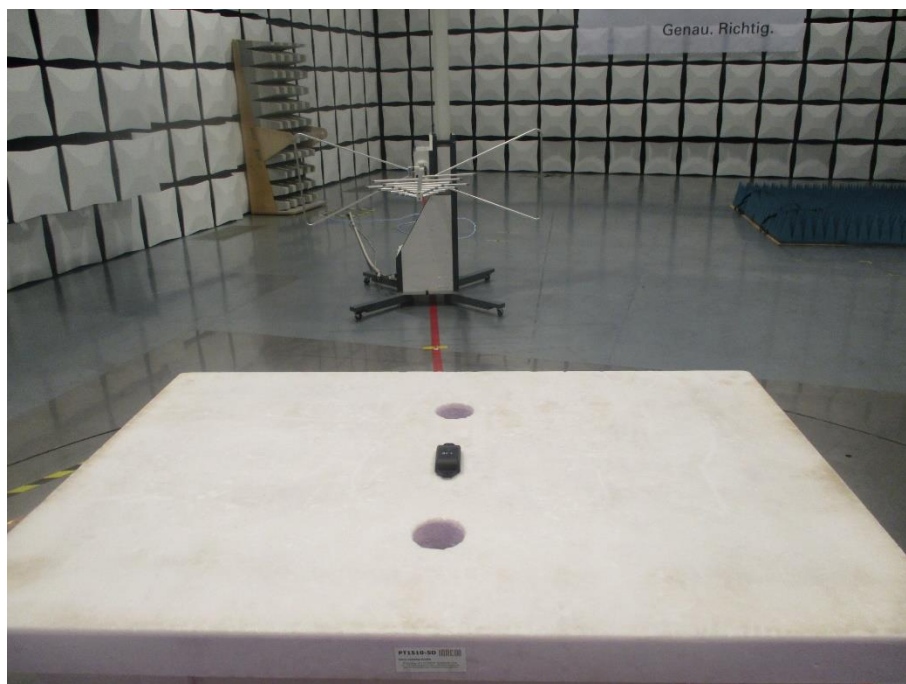
Pass

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6 Test Setup Photos



Test Setup: Radiated Measurements (9 kHz - 30 MHz)

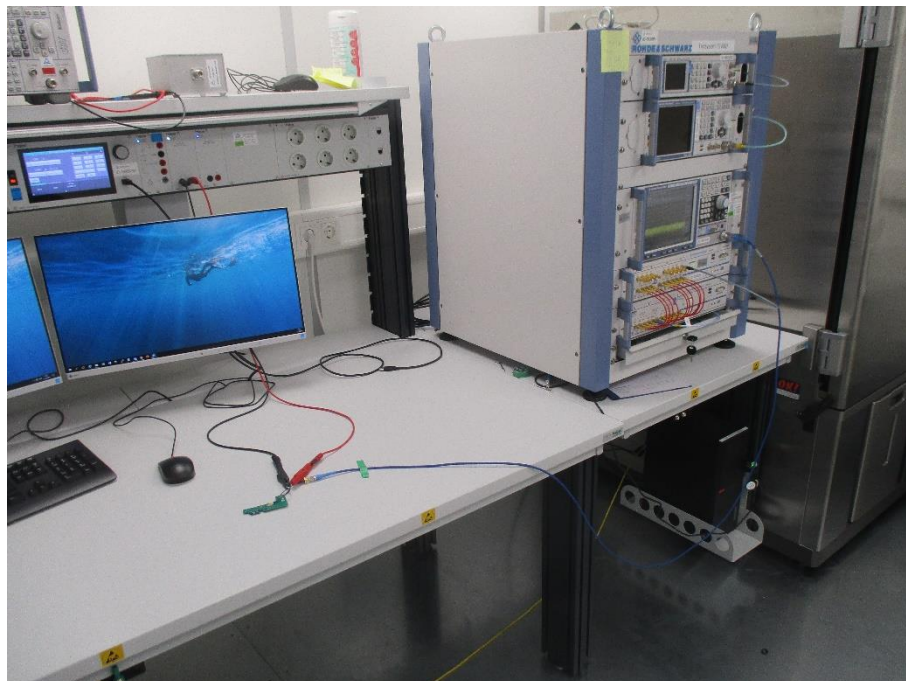


Test Setup: Radiated Measurements (30 MHz - 1 GHz)

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Test Setup: Radiated Measurements (1 GHz to 10 GHz)



Test Setup: Conducted Measurements

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End of Test Report