



IMQ S.p.A. - Società con Socio Unico
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TEST REPORT

No. AR16-0002224-01-3

performed in accordance with

FCC Rules: Code of Federal Regulations (CFR) no. 47
Part 15 Subpart C Section 15.249

PRODUCT	RF Module
MODEL(s) TESTED	SPSGRFC-915
FCC ID	S9NSPSGRFC
TRADE MARK(s)	STMicroelectronics

APPLICANT	STMicroelectronics S.r.l. ~ Centro Direzionale Colleoni - Palazzo Andromeda 3 I-20864 Agrate Brianza (MB)
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Tested by	Robertino Torri [Laboratory technician]	
Approved by	Giovanni Di Turi [Laboratory manager]	 

Revision Sheet

Release No.	Date	Revision Description
Rev. 0	2016-09-19	First edition Digital signed - AR16-0002224-01-3_TR_FCC 15.249_STMICELECTRONICS_Modulo SPSGRFC-915
Rev. 1	2016-11-02	Adjustment page 6 Operating condition EUT and support equipment, page 8 insert ANSI C63.10-2013, page 10 Antenna requirement, § 7.4 test on "Conducted disturbance on AC Notebook power port", page 33 instrumentation list and page 36 insert tests uncertainty Digital signed - AR16-0002224-01-3 rev.1_TR_FCC 15.249_STMICELECTRONICS_Modulo SPSGRFC-915

The results of tests and checks reported in this Test Report refer exclusively to the samples tested and described in the Report itself.

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1. GENERAL DATA

SAMPLE		
Samples received on	2016-07-20	(Item(s) sampled and sent by applicant)
IMQ reference samples	BEM	82715
Samples tested No.	1	
Object under analysis recognition	Not carried out Except where stated, characteristics of products were taken from client description and were not verified by the laboratory	
Date of acceptance of test item	2016-07-20	
TEST LOCATION		
Testing dates	2016-07-20 ÷ 2016-11-02	
Testing laboratory.	IMQ S.p.A. - Via Quintiliano, 43 – I-20138 Milano	
Testing site	Viale Lombardia, 20 – I-20021 Bollate (MI) Via Quintiliano, 43 – I-20138 Milano	
ENVIRONMENTAL CONDITIONING		
Parameter	Measured	
Ambient Temperature	25 ÷ 35 °C	
Relative Humidity	50 ÷ 60 %	
Atmospheric Pressure	900 ÷ 1000 mbar	
REMARKS		
Throughout this report a point is used as the decimal separator. The ability or reliability of this product to perform its intended function in a particular application has not been investigated. IMQ declines any responsibility derived from missing or wrong information provided aside by the applicant.		

2. REFERENCE DOCUMENT

	DOCUMENT	DATE	TITLE
☒	47 CFR Part 15	2015	Radio Frequency Device
☒	ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
☒	ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

3. UNIT UNDER TEST (EUT) DETAILS

GENERAL DATA

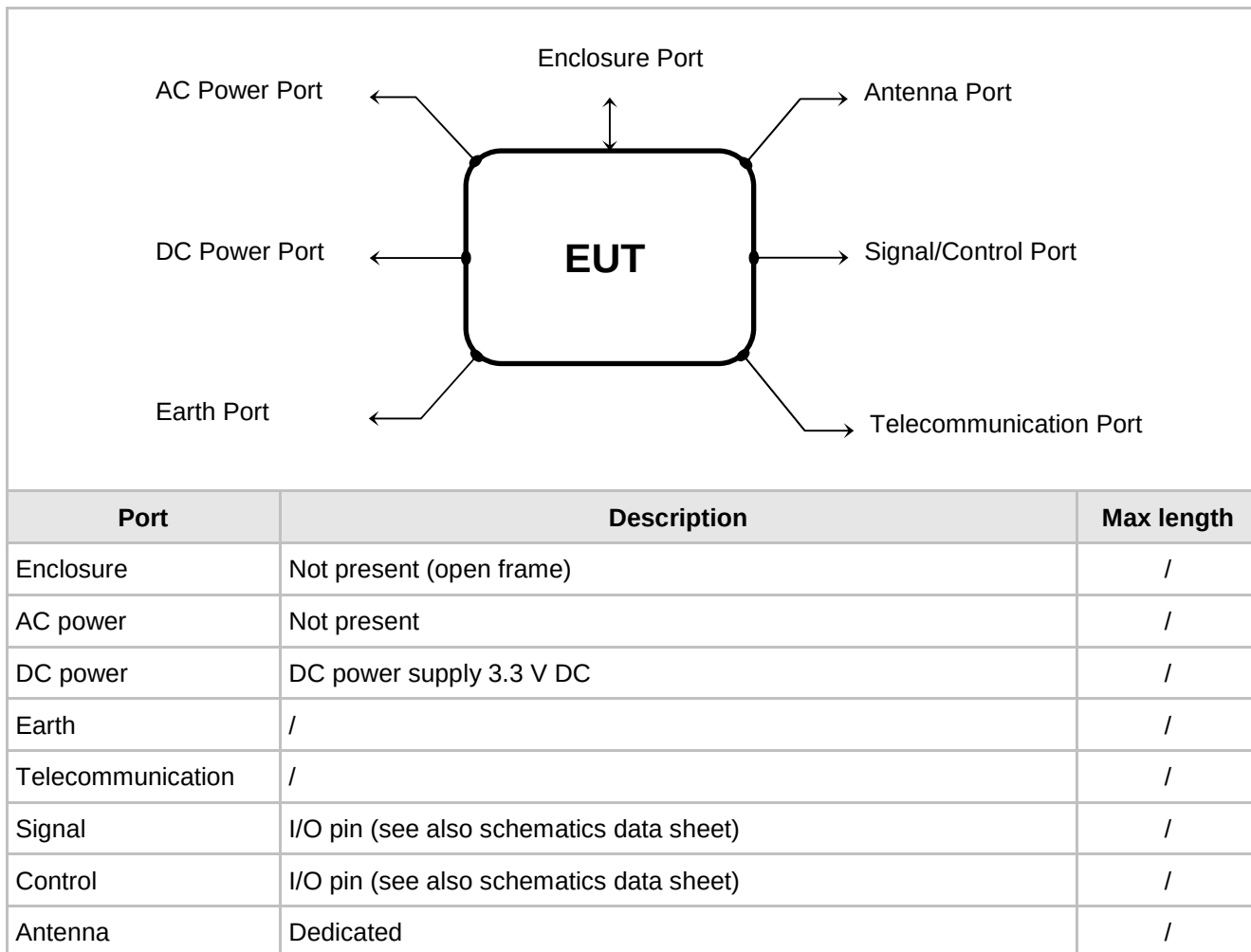
MODEL (basic)	Description
SPSGRFC-915	RF Module
VARIANTS (derived)	Description
/	/
FCC ID	S9NSPSGRFC
Manufacturer	STMicroelectronics S.r.l. ~ Centro Direzionale Colleoni - Palazzo Andromeda 3 I-20864 Agrate Brianza (MB)
Equipment classification	According to the definition 15.3 (o) EUT is a Intentional Radiator operating within the bands 902 ÷ 928 MHz so it shall fulfill provisions of 47CFR Part 15 Subpart C – Intentional radiators – and Section 15.249
Type of equipment	Radio module
Operating frequency	902.5 ÷ 927.5 MHz
Field strength	93,29 dBµV/m
Modulation	OOK and ASK
Channel Spacing	/
Antenna Type	External antenna with RP-SMA connector and adapter for U.FL connector (TAOGLASS mod.TI.19.2113 gain +2.5 dBi)
Peripherals included (for system application)	None
Interfaces	None
Integrated interfaces	None
AC adapter	/
Remarks	The antenna have been furnished by applicant for tests

RF parameters will be those used on transceiver module during test for limits compliance in FCC certification.

Operation band MHz	Modulation	Data rate Min/Max [kbps]	Frequency deviation Min/Max [kHz]	Output power maximum [dBm]
902.5 ÷ 927.5	OOK / ASK	1/250	20/732	+4

4. TEST CONFIGURATION OF UNIT UNDER TEST

EUT PORTS



STATE OF THE EUT DURING TESTS

Ref.	Mode	Description
#1	Operating	Continuous transmission (single channel transmission) supply by dedicated dongle. The EUT is installed on module device board (dongle). The dongle is powered from the USB cable port. The USB cable is connected to Notebook. The EUT is in continuously transmitting at the highest power with 100% approximately duty cycle.

SUPPORT EQUIPMENT

Defined as equipment needed for correct operation or loading of the EUT, but not considered as tested:

Equipment	Manufacturer	Model
Dongle furnished by manufacturer for supply and management of radio module	ST Microelectronics	PC92A V01
Notebook for dongle management and supply	IBM	1830

ELECTROMAGNETICALLY RELEVANT COMPONENTS

Component	No.	Manufacturer	Model
Radio module	1	STMicroelectronics	PC74A V01
Antenna	1	TAOGLASS	TI.19.2113

RFI SUPPRESSION DEVICES

Component	No.	Manufacturer	Model
/	/	/	/

EMI PROTECTION DEVICES

Component	No.	Manufacturer	Model
/	/	/	/

EUT TECHNICAL DOCUMENTATION

Document	Reference
None	/

5. METHODS OF MEASUREMENT

All compliance measurements have been carried out using the procedures described in the standard ANSI C63.4-2014 (excluding sub-par. 4.1.5.2, 5.7.9 and 14), ANSI C63.10-2013 and Section 15.31 of CFR47 Part 15 – Subpart A (General).

Additional test requirements have been adopted according to the reference Section indicated in the Test Table.

FREQUENCY RANGE INVESTIGATED

Radiated emission tests: from 9 kHz to tenth harmonic of fundamental.

6. SUMMARY OF TEST RESULTS

POSSIBLE TEST CASE VERDICTS:	
Test object meets the requirement	PASS
Test object does not meet the requirement	FAIL
Test case does not apply to the test object	N.A.
Test not performed	N.P.

CFR47 Part 15	TITLE	RESULT
§ 15.203	Antenna Requirements	PASS
§ 15.205 (a)	Restricted band of operation	PASS
§ 15.205 (b) § 15.215 (b) § 15.249 (d)	Radiated Emission 9kHz to 30MHz 30MHz to 10GHz	PASS
§ 15.207 (a)	Conducted emission	PASS
§ 15.215 (c)	Bandwidth of emission (20dB Bandwidth)	PASS
§ 15.249(a)	Field strength of fundamental	PASS
§ 15.249 (a)	Radiated emission measurement of harmonics	PASS
§ 1.1307(b)(1)	RF exposure evaluation	PASS

7. TEST RESULTS

7.1 ANTENNA REQUIREMENTS

TEST REQUIREMENT

According to CFR 47 Part 15, section 15.203 / 15.204.

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 Sections 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 Section 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.

Testing dates	2016-07-20
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Antenna specifications

N° of authorized antenna types	1
Antenna type	External RP-SMA connector (From antenna to RF module by cable adapter U.FL/SMA RP)
Maximum total gain	+2.5 dBi (rated)
External power amplifiers	Not present

TEST RESULT

The EUT meets the requirements of sections 15.203 and 15.204.

7.2 RESTRICTED BAND OF OPERATION

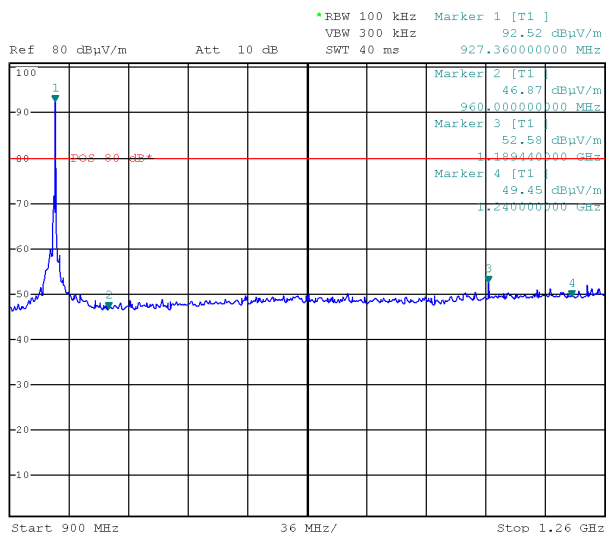
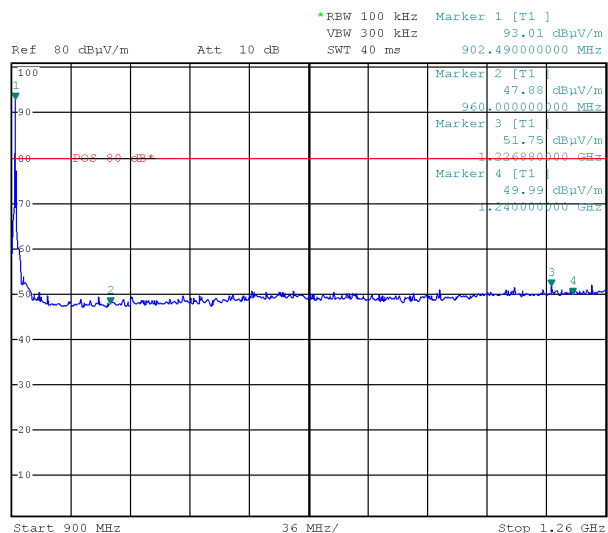
TEST REQUIREMENT		
Test setup	ANSI C63.4	
Test facility	Semi-anechoic chamber	
Test distance	3 m	
Frequency range	960 ÷ 1240	
RBW bandwidth	100 kHz	
VBW bandwidth	300 kHz	
Detector	Peak	
EUT operating condition	#1	
Testing dates	2016-07-25	

LIMITS		
Band of operations	Peak (dB μ V/m)	Average Limit (dB μ V/m)
Restricted bands (§ 15.205)	74	54

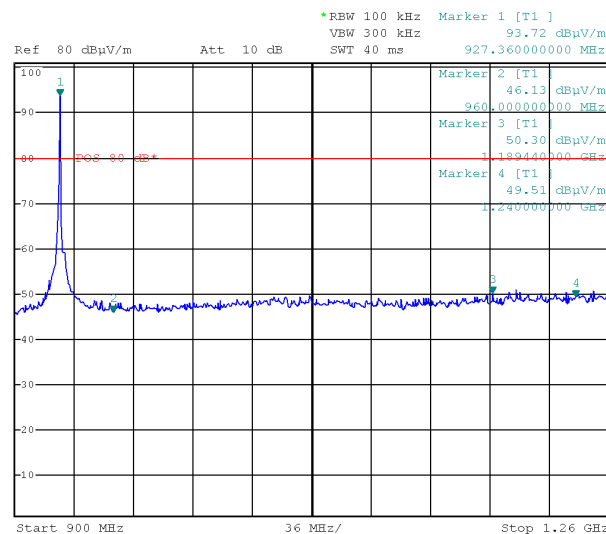
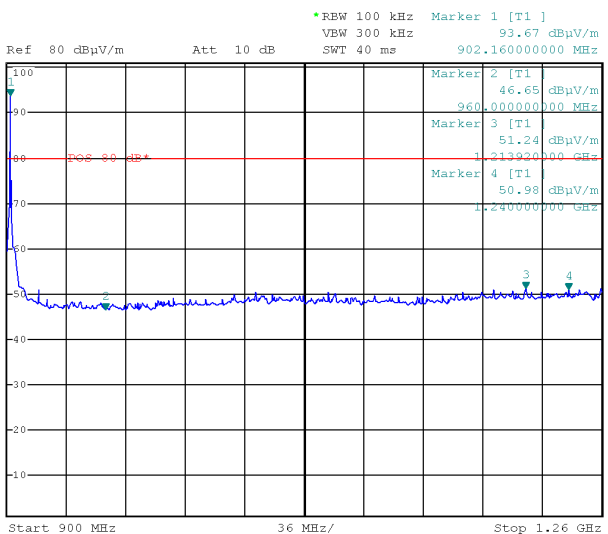
TEST PROCEDURE		
1) The EUT was placed on turntable which is 0.8 m above the ground plane 2) The turntable shall rotate from 0° to 360° degrees to determine the position of maximum emission level. 3) The EUT is positioned 3 m away from the receiving antenna which varied from 1 to 4 m to find the highest emission. 4) The measurements were made with EUT set to operate at 100% of duty cycle and maximum power with normal modulation 5) The receiving antenna was positioned in both horizontal and vertical polarization.		

MEASUREMENTS RESULTS AT LOWEST AND HIGHEST FREQUENCY TRANSMISSION

Modulation: ASK



Modulation: OOK



TEST RESULT

The EUT meets the requirements of sections 15.205 (a)

7.3 RADIATED EMISSIONS

TEST REQUIREMENT	
Test setup	ANSI C63.4 § 5.5
Test facility	Semi-anechoic chamber below 1 GHz; for measurement above 1 GHz are used 2.4 m by 2.4 m RF absorbing material covering the ground plane between the antenna and the EUT
Test distance	3 meters
Frequency range	9 kHz to tenth harmonic of fundamental
IF bandwidth (below 30 MHz)	9 kHz
IF bandwidth (below 1,000 MHz)	120 kHz
IF bandwidth (above 1,000 MHz)	1 MHz
Deviation to test procedure	None
EUT operating condition	#1
Remark	(*) In accordance with part 15.31 (f) (2), where the measurement distance was specified to be 30 or 300 meters, a correction factor was applied in order to permit measurement to be performed at a separation distance. The applied formula for limits at 3 meter is: Extrapolation (dB) = $40\log(300\text{meter} / 3\text{meter}) = +80\text{dB}$ Extrapolation (dB) = $40\log(30\text{meter} / 3\text{meter}) = +40\text{dB}$
Testing dates	2016-07-25

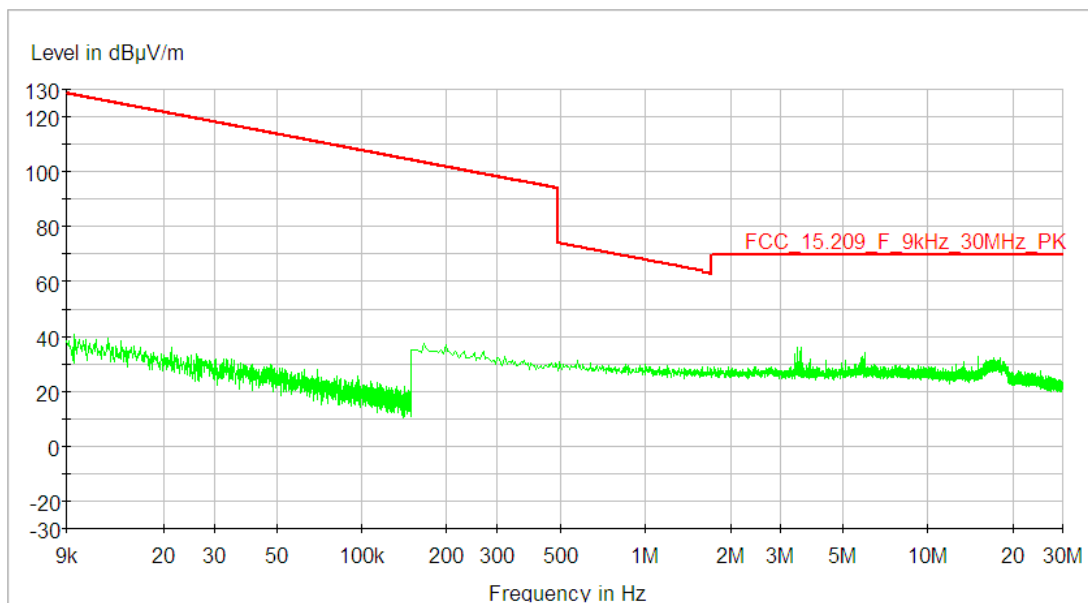
LIMITS		
Band of operations	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)
Restricted bands (§ 15.205)	74	54
Other bands	According to § 15.209 or fundamental –50dB (whichever is the lesser attenuation)	According to § 15.209 or fundamental –50dB (whichever is the lesser attenuation)

TEST PROCEDURE
1) The EUT was placed on turntable which is 0.8 m above the ground plane 2) The turntable shall rotate from 0° to 360° degrees to determine the position of maximum emission level. 3) The EUT is positioned 3 m away from the receiving antenna which varied from 1 to 4 m to find the highest emission. 4) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 120 kHz below 1000 MHz and 1 MHz above 1000 MHz. 5) The receiving antenna was positioned in both horizontal and vertical polarization. 6) The measurements with Quasi-Peak detector, below 1000 MHz are performed only for frequencies for which the Peak values are $\geq$ Q.P. limit – 6 dB (♦ mark symbol).

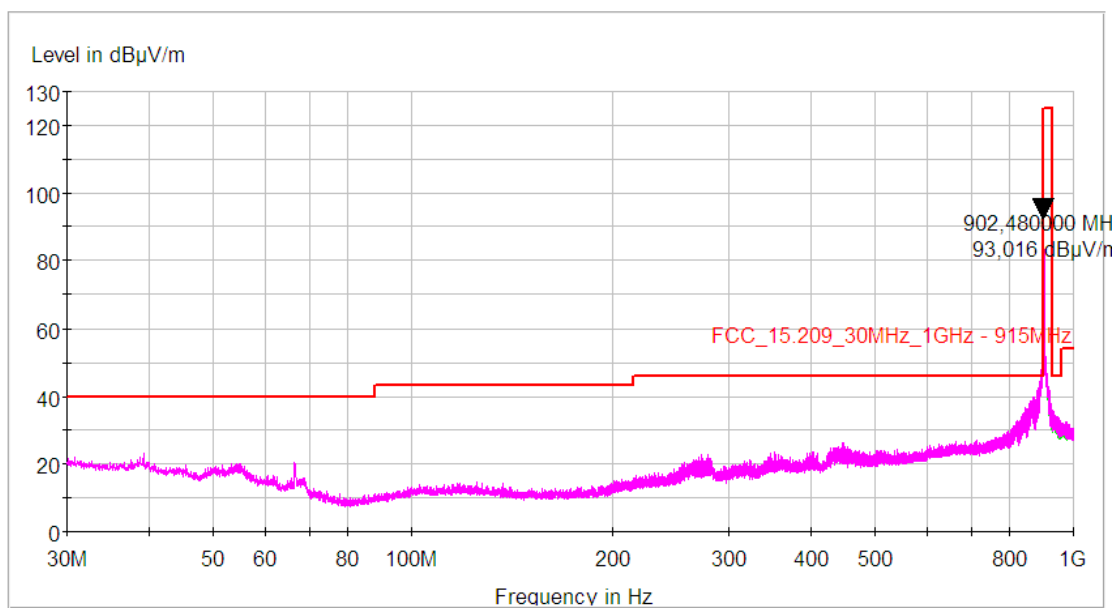
MEASUREMENTS RESULTS

Modulation: ASK

Range: 9kHz ÷ 30 MHz

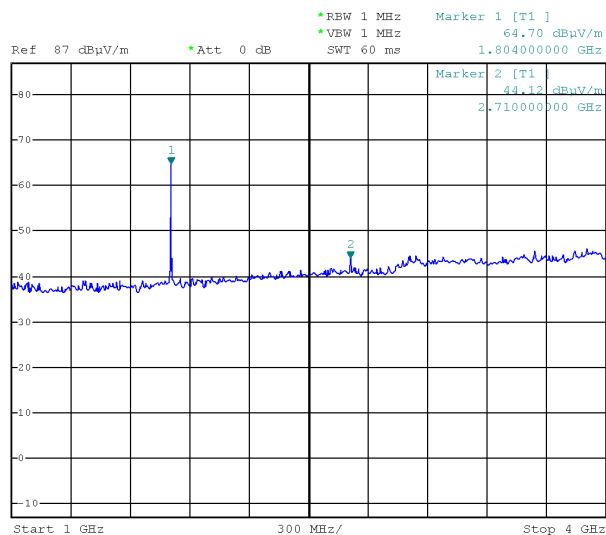


Range: 30 MHz ÷ 1000 MHz

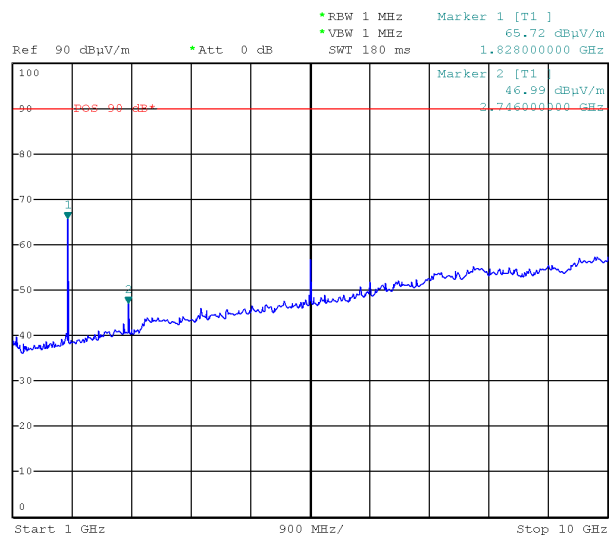


1000 MHz ÷ 10000 MHz

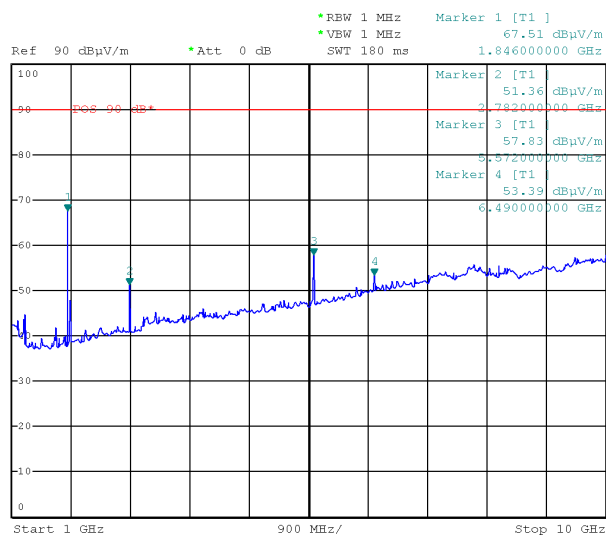
Lowest frequency



Middle frequency

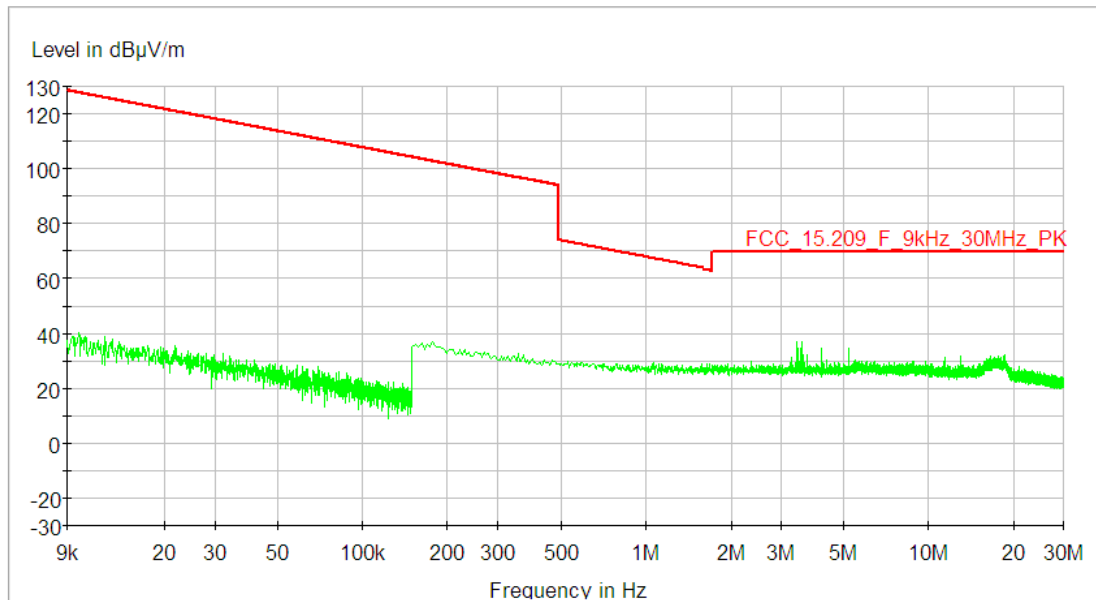


Highest frequency

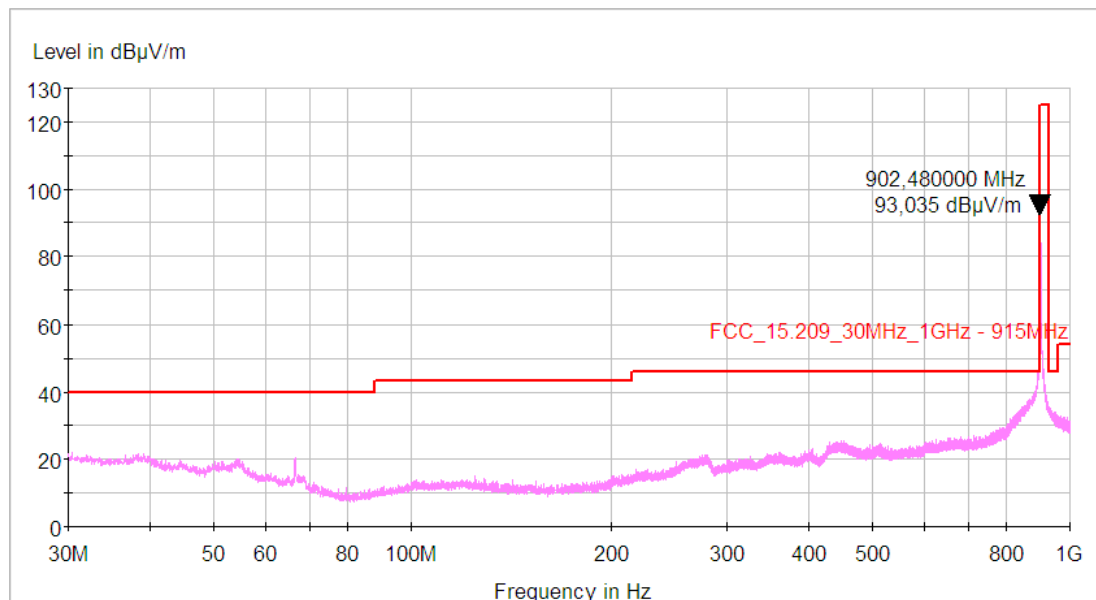


Modulation: OOK

Range: 9kHz ÷ 30 MHz

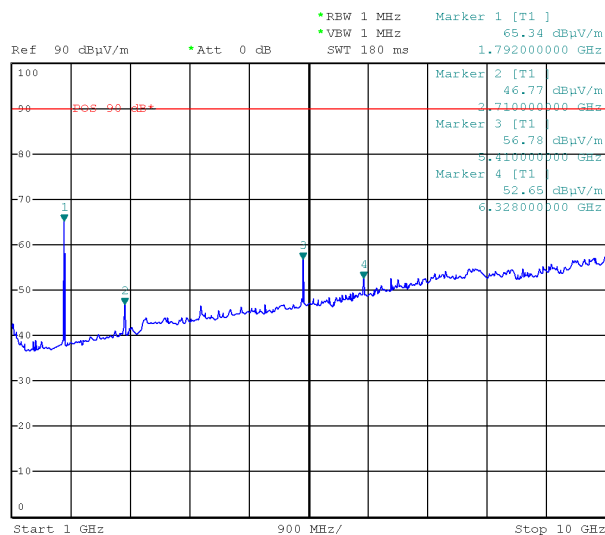


Range: 30 MHz + 1000 MHz

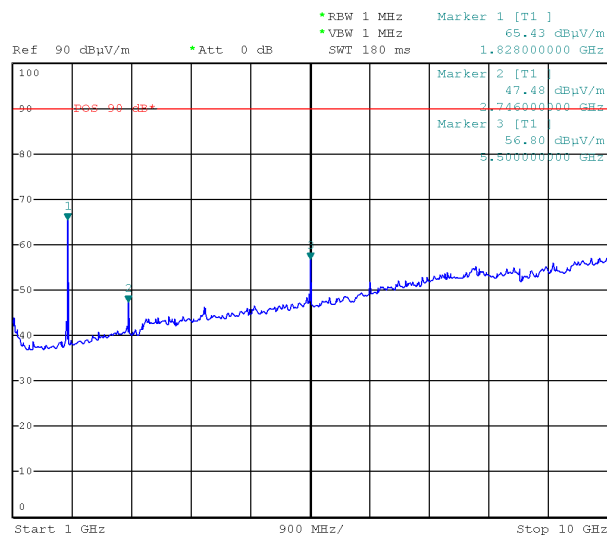


1000 MHz ÷ 10000 MHz

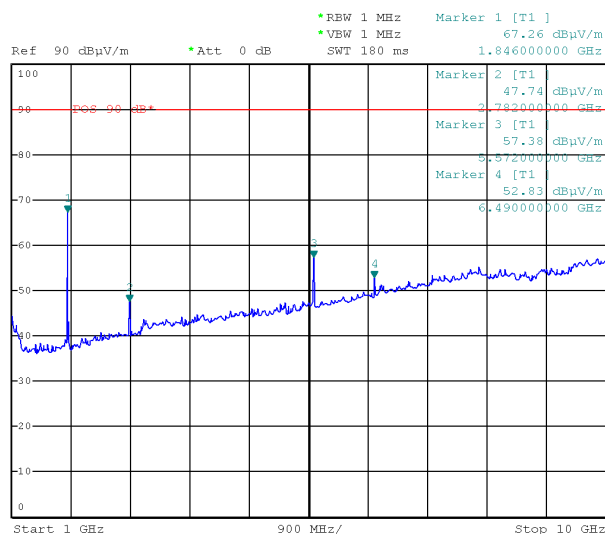
Lowest frequency



Middle frequency



Highest frequency



TEST RESULT

The EUT has been tested in 3 orthogonal axes at the frequencies lowest, middle and highest for each modulation.

The results reported are worst case.

The measurement of spurious emission of EUT in receiver mode is deemed to be fulfilled as no limits are exceeded in transmitter mode (condition considered more burdensome).

The EUT meets the requirements of sections 15.205 (b), 15.215 (b) and 15.249 (d).

7.4 CONDUCTED EMISSION

TEST REQUIREMENT	
Test setup	ANSI C63.4
Test facility	Shielded chamber
Frequency range	150 kHz – 30 MHz
IF bandwidth	9 kHz
EMC class	B
EUT operating condition	#1
Testing dates	2016-11-02

LIMITS		
Band of operations	Quasi-Peak (dBμV)	Average Limit (dBμV)
0.15 ÷ 0.5	66 ÷ 56	56 ÷ 46
0.5 ÷ 5	56	46
5 ÷ 30	60	50

TEST RESULT

The EUT meets the requirements of sections 15.207 (a).

TEST PROCEDURE

- 1) The EUT was placed on a wooden table of size, 80 cm by 80 cm, raised 80 cm in which is located 40 cm away from the vertical wall the shielded room.
- 2) Each EUT power cord input cord was individually connected through a 50Ω/50μH LISN to the input power source.
- 3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
- 4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
- 5) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 9 kHz during the measurements.
- 6) The measurements with Quasi-Peak detector are performed only for frequencies for which the Peak values are $\geq$ (Q.P. limit - 6 dB).

MEASUREMENTS RESULTS

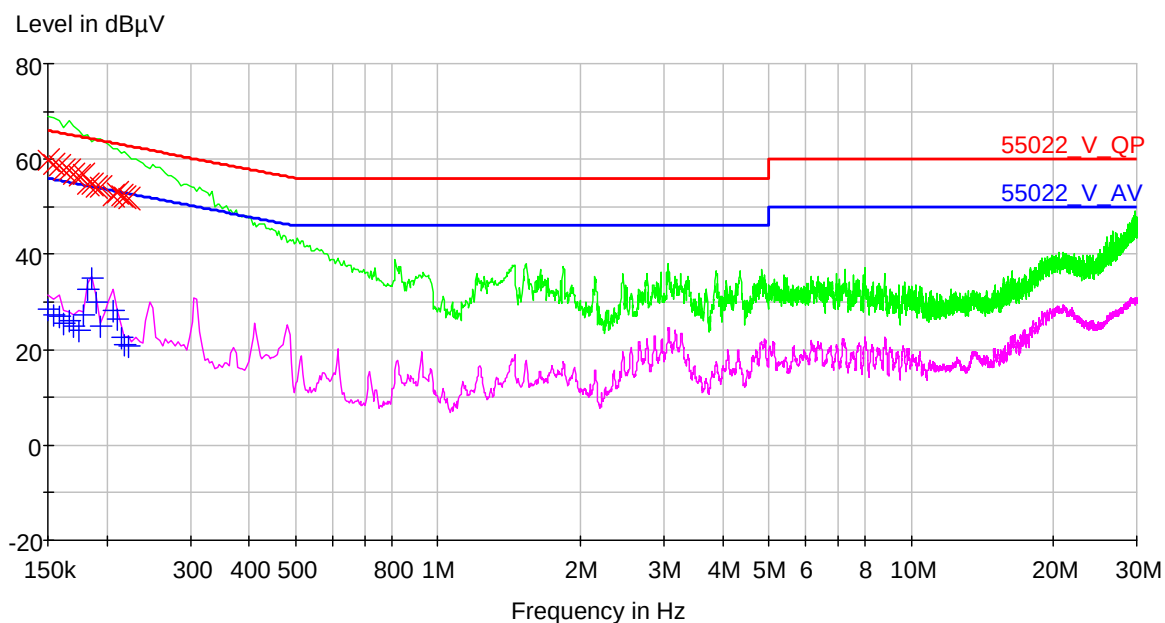
Conducted disturbance on AC Notebook power port

150 kHz+30 MHz

Modulation: ASK

☒ **Peak detector** (Quasi-Peak detector: X marked points)

☒ **Average detector** (Average detector 1 sec: + marked points)



MEASUREMENTS RESULTS

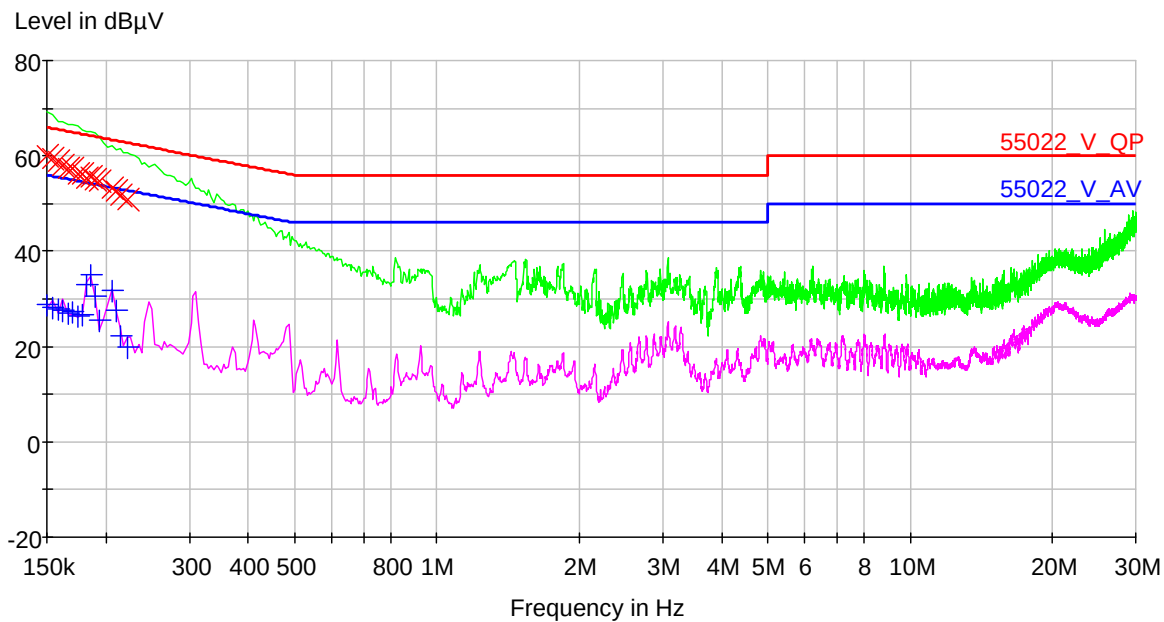
Conducted disturbance on AC Notebook power port

150 kHz+30 MHz

Modulation: OOK

☒ Peak detector (Quasi-Peak detector: X marked points)

☒ Average detector (Average detector 1 sec: + marked points)

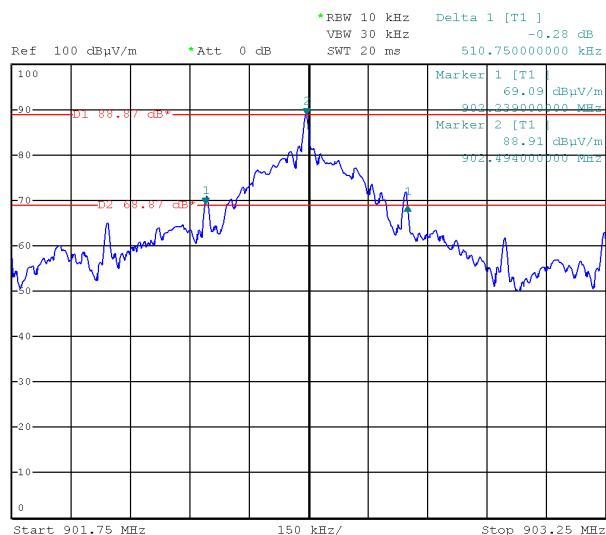


7.5 BANDWIDTH OF EMISSIONS (20 dB BANDWIDTH)

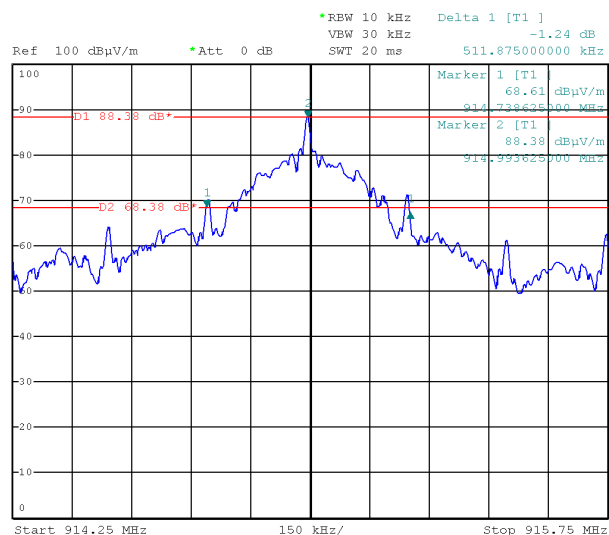
TEST REQUIREMENT	
Spectrum analyzer settings	
Span	Wide enough to capture the peak level of the emission operating on the channel
Resolution bandwidth (RBW)	10 kHz
Video bandwidth (VBW)	30 kHz
Sweep time (SWT)	Auto
Detector function	Peak
Trace	Max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None
Testing dates	2016-07-28

Modulation: ASK

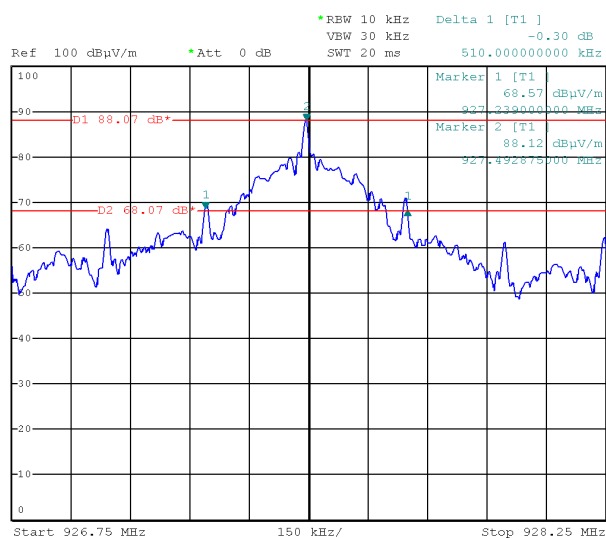
Lowest frequency



Middle frequency

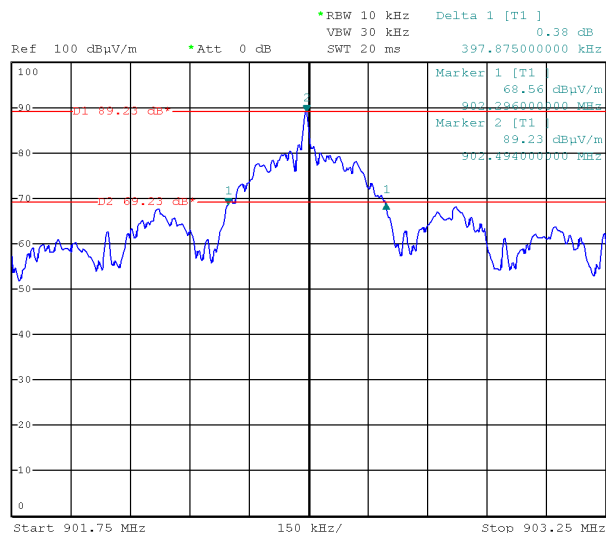


Highest frequency

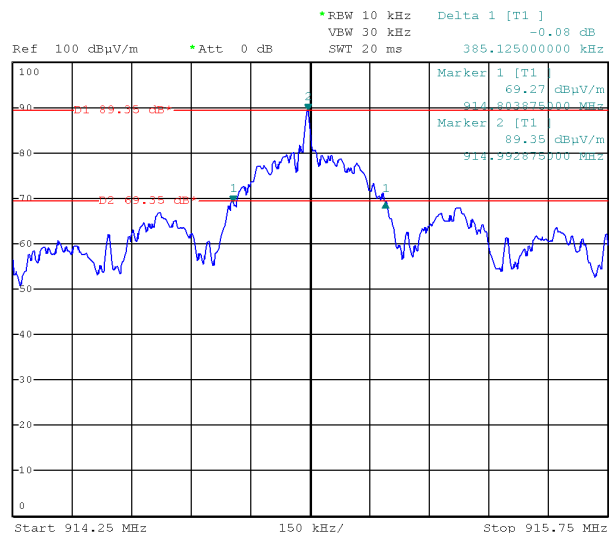


Modulation: OOK

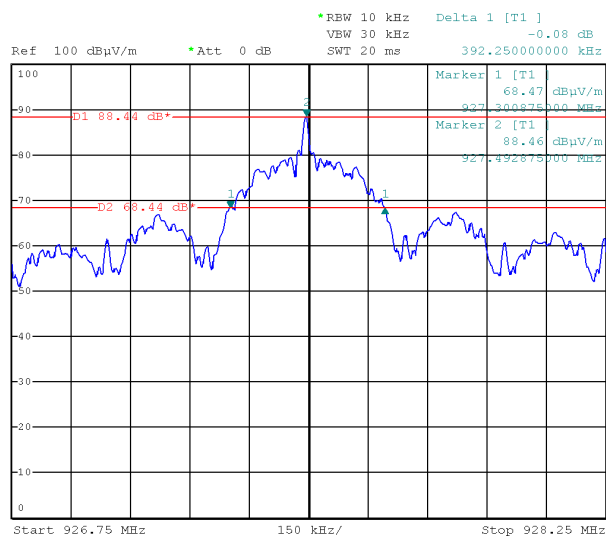
Lowest frequency



Middle frequency



Highest frequency

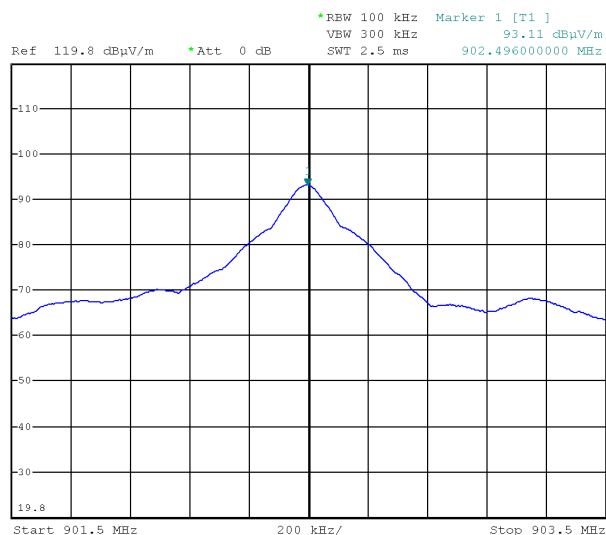


7.6 FIELD STRENGTH OF FUNDAMENTAL

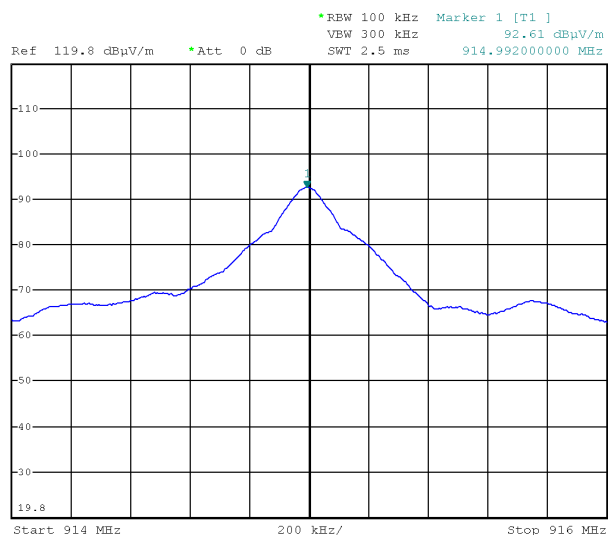
TEST REQUIREMENT	
Spectrum analyzer settings	
Span	Wide enough to capture the peak level of the emission
Resolution bandwidth (RBW)	100 kHz
Video bandwidth (VBW)	Auto
Sweep time (SWT)	Auto
Detector function	Peak
Trace	Max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None
Testing dates	2016-07-21
TEST PROCEDURE	
1) The EUT was placed on turntable which is 0.8 m above the ground plan 2) The turntable shall rotate from 0° to 360° degrees to determine the position of maximum emission level. 3) The EUT is positioned 3 m away from the receiving antenna which varied from 1 to 4 m to find the highest emission. 4) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 100 kHz. 5) The receiving antenna was positioned in both horizontal and vertical polarization.	
LIMITS	
94 dBμV/m	
TEST RESULT	
The EUT meets the requirements of sections 15.249 (a).	

Modulation: ASK

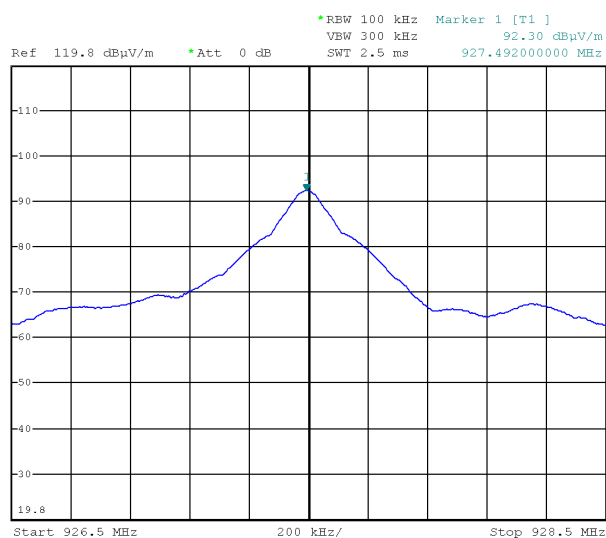
Lowest frequency



Middle frequency



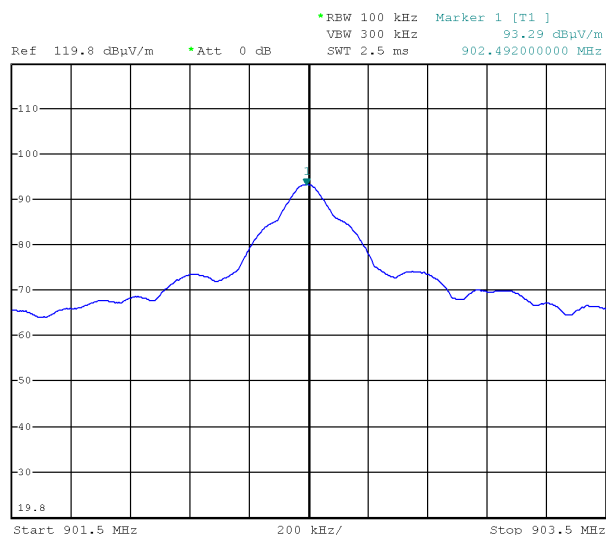
Highest frequency



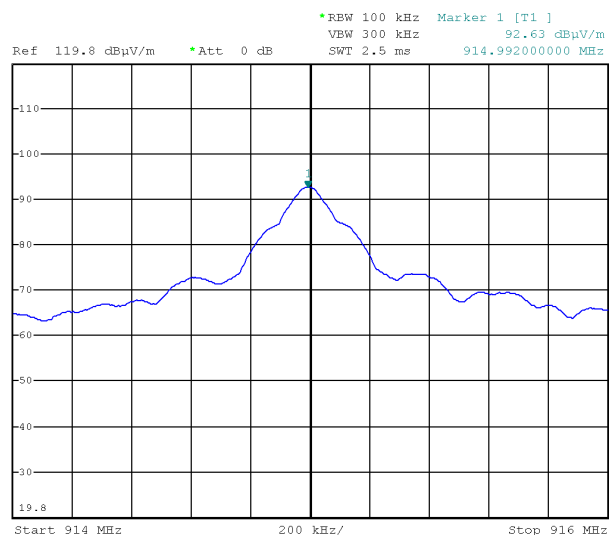
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Modulation: OOK

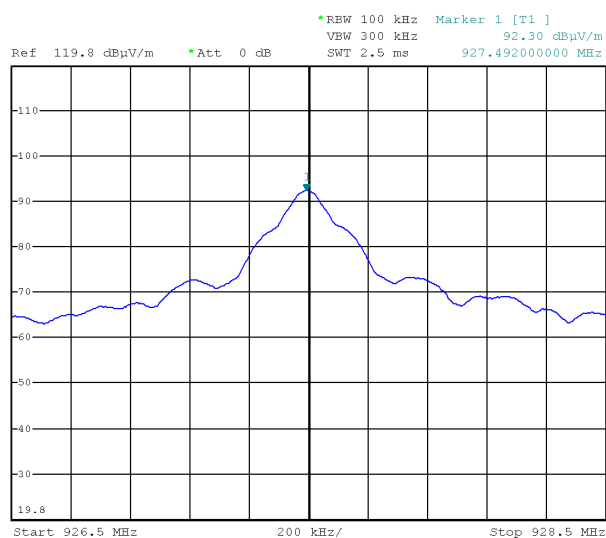
Lowest frequency



Middle frequency



Highest frequency



/

7.7 FIELD STRENGTH OF HARMONICS

TEST REQUIREMENT	
Spectrum analyzer settings	
Resolution bandwidth (RBW)	1 MHz
Detector function	Peak
Trace	Max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None
Testing dates	2016-09-06

TEST PROCEDURE
1) The EUT was placed on turntable which is 0.8 m above the ground plan 2) The turntable shall rotate from 0° to 360° degrees to determine the position of maximum emission level. 3) The EUT is positioned 3 m away from the receiving antenna which varied from 1 to 4 m to find the highest emission. 4) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 1 MHz. 5) The receiving antenna was positioned in both horizontal and vertical polarization.

Modulation ASK

MEASUREMENTS RESULTS AT LOWEST FREQUENCY TRANSMISSION

Frequency MHz	Antenna polarization	Detector	Receiver reading dBμV	Correction factor dB	Final value dBμV/m	Limit dBμV/m	Margin dB
1805	H	Peak	69.04	-7.34	61.70	74	-12.30
2707	H	Peak	61.21	-4.16	57.05	74	-16.95
6318	H	Peak	54.50	+5.42	59.92	74	-14.08

MEASUREMENTS RESULTS AT MIDDLE FREQUENCY TRANSMISSION

Frequency MHz	Antenna polarization	Detector	Receiver reading dBμV	Correction factor dB	Final value dBμV/m	Limit dBμV/m	Margin dB
1830	H	Peak	71.05	-7.34	63.71	74	-10.29
2745	H	Peak	52.20	-4.16	48.04	74	-25.96
5490	H	Peak	51.39	+3.15	54.54	74	-19.46

MEASUREMENTS RESULTS AT HIGHEST FREQUENCY TRANSMISSION

Frequency MHz	Antenna polarization	Detector	Receiver reading dBμV	Correction factor dB	Final value dBμV/m	Limit dBμV/m	Margin dB
1855	H	Peak	70.59	-7.34	63.25	74	-10.75
2782	H	Peak	52.49	-4.16	48.33	74	-25.67
5565	H	Peak	51.10	+3.15	54.25	74	-19.75

MEASUREMENTS RESULTS AT LOWEST FREQUENCY TRANSMISSION

Frequency MHz	Antenna polarization	Detector	Receiver reading dBμV	Correction factor dB	Final value dBμV/m	Limit dBμV/m	Margin dB
1805	H	Average	52.63	-7.34	45.29	54	-8.71
2707	H	Average	43.91	-4.16	39.75	54	-14.25
6318	H	Average	40.68	+5.42	46.10	54	-7.9

MEASUREMENTS RESULTS AT MIDDLE FREQUENCY TRANSMISSION

Frequency MHz	Antenna polarization	Detector	Receiver reading dBμV	Correction factor dB	Final value dBμV/m	Limit dBμV/m	Margin dB
1830	H	Average	56.40	-7.34	49.06	54	-4.94
2745	H	Average	38.88	-4.16	34.72	54	-19.28
5490	H	Average	43.79	+3.15	46.94	54	-7.06

MEASUREMENTS RESULTS AT HIGHEST FREQUENCY TRANSMISSION

Frequency MHz	Antenna polarization	Detector	Receiver reading dBμV	Correction factor dB	Final value dBμV/m	Limit dBμV/m	Margin dB
1855	H	Average	54.93	-7.34	47.59	54	-6.41
2782	H	Average	38.55	-4.16	34.39	54	-19.61
5565	H	Average	43.18	+3.15	46.33	54	-7.67

Modulation OOK

MEASUREMENTS RESULTS AT LOWEST FREQUENCY TRANSMISSION

Frequency MHz	Antenna polarization	Detector	Receiver reading dBμV	Correction factor dB	Final value dBμV/m	Limit dBμV/m	Margin dB
1805	H	Peak	66.22	-7.34	58.88	74	-15.12
2707	H	Peak	61.74	-4.16	57.58	74	-16.42

MEASUREMENTS RESULTS AT MIDDLE FREQUENCY TRANSMISSION

Frequency MHz	Antenna polarization	Detector	Receiver reading dBμV	Correction factor dB	Final value dBμV/m	Limit dBμV/m	Margin dB
1830	H	Peak	73.48	-7.34	66.14	74	-7.86
2745	H	Peak	54.22	-4.16	50.06	74	-23.94

MEASUREMENTS RESULTS AT HIGHEST FREQUENCY TRANSMISSION

Frequency MHz	Antenna polarization	Detector	Receiver reading dBμV	Correction factor dB	Final value dBμV/m	Limit dBμV/m	Margin dB
1855	H	Peak	70.77	-7.34	63.43	74	-10.57
2782	H	Peak	52.44	-4.16	48.28	74	-25.72
5565	H	Peak	51.16	+3.15	54.31	74	-19.69

MEASUREMENTS RESULTS AT LOWEST FREQUENCY TRANSMISSION

Frequency MHz	Antenna polarization	Detector	Receiver reading dBμV	Correction factor dB	Final value dBμV/m	Limit dBμV/m	Margin dB
1805	H	Average	56.12	-7.34	48.78	54	-5.22
2707	H	Average	47.16	-4.16	43.00	54	-11.00

MEASUREMENTS RESULTS AT MIDDLE FREQUENCY TRANSMISSION

Frequency MHz	Antenna polarization	Detector	Receiver reading dBμV	Correction factor dB	Final value dBμV/m	Limit dBμV/m	Margin dB
1830	H	Average	57.90	-7.34	50.56	54	-3.44
2745	H	Average	41.35	-4.16	37.19	54	-16.81

MEASUREMENTS RESULTS AT HIGHEST FREQUENCY TRANSMISSION

Frequency MHz	Antenna polarization	Detector	Receiver reading dBμV	Correction factor dB	Final value dBμV/m	Limit dBμV/m	Margin dB
1855	H	Average	55.59	-7.34	48.25	54	-5.75
2782	H	Average	40.07	-4.16	35.91	54	-18.09
5565	H	Average	43.57	+3.15	46.72	54	-7.28

TEST RESULT

All out of band spurious emissions are more 20 dB below the in band power of the fundamental.
The EUT meets the requirements of sections 15.249 (a).

7.8 RF EXPOSURE EVALUATION

TEST REQUIREMENT

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines § 1.1307(b)(1).

EUT classification (fixed, mobile or portable devices)	Portable according to § 2.1093(b) of this Chapter
Deviation to test procedure	None
EUT operating condition	#1
Remark	None

Limit for maximum permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Average Time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3÷3.0	614	1.63	(100)*	6
3.0÷30	1842/f	4.89/f	(900/f ²)*	6
30÷300	61.4	0.163	1.0	6
300÷1500	--	--	f/300	6
1500÷100,000	--	--	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3÷3.0	614	1.63	(100)*	30
3.0÷30	824/f	2.19/f	(180/f ²)*	30
30÷300	27.5	0.073	0.2	30
300÷1500	--	--	f/1500	30
1500÷100,000	--	--	1.0	30

F = Frequency in MHz *Plane-wave equivalent power density

The distance from the device's transmitting antenna where the exposure level reaches the maximum permitted limit is calculated using the general equation:

$$S = P \cdot G / 4\pi R^2$$

Where:

S = Power Density (mW/cm²)

P = Conducted power (mW)

G = Linear power gain relative to isotropic radiator (numeric gain)

R = Distance (cm)

RF Exposure evaluation

Low threshold limit			
Exposure category	Frequency range f_{MHz}	Limit	Limit value (mW/cm ²)
General population	902.5	$f_{\text{MHz}}/1500$	0.602

Both conducted and radiated (EIRP) output power values must be compared to the threshold limit.

MEASUREMENTS RESULTS

highest output power (radiated) (dBm)	Power density @ 20 cm (mW/cm ²)	Distance where the exposure level reaches the limit (cm)	Limits (mW/cm ²)
-1.94	0,00012733	0.226	0.602

TEST RESULT

This value is less than the low threshold limit corresponding to the general population exposure category and therefore no SAR test is required.

8. MEASUREMENTS AND TESTS UNCERTAINTY

Unless otherwise stated the uncertainties for the tests and measurements are evaluated in according to IMQ Operational Instruction IO-LAB-001 and IO-LAB-004. and requirement of NIST Technical Note 1297 and NIS 81: 1994 “The Treatment of Uncertainty in EMC Measurements”

The expanded uncertainty was calculated for all measurements and tests listed in this test report according to CISPR 16-4-2 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainty in EMC Measurements”, with UKAS document LAB 34 and is documented in the quality system accordance to ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device

Internal Procedure PI-037 ensures that the requirements for traceability of calibrations, of all test equipment requiring calibration, and calibration intervals are met.

Methods/Standard	Parameter	Expanded Uncertainty	Unit	Confidence level	Coverage Factor	Degree of freedom
Continuous disturbance	QP detector 9 – 150 kHz	2,47	dB	95%	2,00	25
	QP detector 150 k – 30 MHz	2,61	dB	95%	2,00	26
	QP detector using Voltage Probe	2,45	dB	95%	2,00	26
	QP detector using ISN	3,15	dB	95%	2,00	> 60
	QP detector using Current Probe	2,15	dB	95%	2,00	35
Radiated disturbance	QP detector (30 MHz - 100 MHz) H polarization	4,33	dB	95%	2,00	> 60
	QP detector (30 MHz - 100 MHz) V polarization	4,22	dB	95%	2,00	> 60
	QP detector (100 MHz - 200 MHz) H polarization	3,40	dB	95%	2,00	> 60
	QP detector (100 MHz - 200 MHz) V polarization	4,76	dB	95%	2,00	> 60
	QP detector (200 MHz - 1000 MHz) H polarization	3,91	dB	95%	2,00	> 60
	QP detector (200 MHz - 1000 MHz) V polarization	3,82	dB	95%	2,00	> 60
	P detector 1-6 GHz	4,77	dB	95%	2,00	> 60
	P detector 6 – 18 GHz	5,14	dB	95%	2,00	> 60

9. LIST OF MEASURING EQUIPMENT AND CALIBRATION INFORMATION

IMQ Serial Number	Instrument	Manufacturer	Type	Last Cal.	Cal. Period.	Calibration Company
P01709	Shielded semi-anechoic chamber	SIDT	/	03-15	24	IMQ
P02486	Turntable controller unit	FRANKONIA	FCTAM01	/	/	/
P02488	Mast antenna	FRANKONIA	FAM4	/	/	/
S03511	Log antenna	ARA	LPB-2520/1	05-15	36	NPL
S03463	Horn Antenna	SCHWARZBECK	BBHA 9120D	12-14	36	NPL
S02508	Loop Antenna	ROHDE & SCHWARZ	HFH2-Z2	01-15	24	SEIBERSDORF
S03629	Spectrum Analyzer	Rohde & Schwarz	FSP40	04-16	12	ROHDE & SCHWARZ
S05562	EMI receiver	ROHDE & SCHWARZ	ESU8	05-15	18	ROHDE & SCHWARZ
S03631	LISN	ROHDE & SCHWARZ	ENV216	03-16	12	I.N.R.I.M
S03542	Preamplifier	Hewlett Packard	HP 8449B	04-16	12	IMQ
S04193	Preamplifier	Bonn Elektronik	BLNA 0110-15C35	05-16	24	IMQ
W-00199/E	Software	ROHDE & SCHWARZ	EMC32 Ver. 6.30	/	/	/
H-00165	PC	/	/	/	/	/

END OF TEST REPORT