

TEST REPORT Secondo i seguenti Standard / According to following Standards	
Test Methods	FCC CFR 47 - Part 2 and Part 15: 2015 (Subpart B e C) ANSI C63.4: 2014 ANSI C63.10: 2013
Test specification	FCC CFR 47 - Part 15: 2017 (Subpart C) Test plan: TP-17LA00054_170110_BV1000CL
Antenna Requirement, FCC Part 15 Section 15.203;	Conforme/Compliant
20 dB Emission Bandwidth, FCC Part 15 Section 15.215 (c);	Conforme/Compliant
Frequency tolerance of the carrier signal, FCC Part 15 Section 15.225 (e);	Conforme/Compliant
AC Power Line Conducted Emissions, FCC Part 15 Section 15.207;	Conforme/Compliant
Spurious Radiated Emissions and Restricted Bands of Operation, FCC Part 15 Section 15.225 (a), (b), (c), 15.209;	Conforme/Compliant
Richiedente / Applicant's name :	Globalcom Engineering S.p.A.
Indirizzo / Address	Via Alessandro Volta, 39, 21010 Cardano al Campo (VA) - ITALY
Produttore / Manufacturer :	Globalcom Engineering S.p.A.
Indirizzo / Address	Via Alessandro Volta, 39, 21010 Cardano al Campo (VA) - ITALY
Dispositivo sottoposto ai test/ Device Under Test :	Contactless Unattended Reader Mod. BV1000CL
Data di emissione/ Date of issue	6 th March 2017
Validità / Validity	Vedi sezione 1.1 / See section 1.1
Test report redatto da/ Author of Test report	Loris Fruch
Tecnico/i di prova Engineer/s	Loris Fruch
Approvato da (+ firma) Approved by (+ signature)	Firmato digitalmente da SILVANO CHIALINA O = non presente C = IT  Responsabile del laboratorio/ Head of the Laboratory
Laboratorio / Testing Laboratory . :	Emilab Srl a Socio Unico
Indirizzo / Address	Via F.lli Solari 5/A – 33020 Amaro (UD) - Italy

Index

1.	INFORMAZIONI GENERALI / GENERAL INFORMATION	4
1.0	Laboratorio / Testing Laboratory	4
1.1	Campionamento e Documentazione / Sampling and Documentation	4
1.2	Specifiche del test / Test specifications	4
1.3	Svolgimento dei test e condizioni generali / Test scheduling and general condition	5
1.4	Espressione dei risultati finali / Test case of final verdicts	5
1.5	Incertezza / Uncertainty	5
1.6	Termini, Definizioni e Acronimi/ Terms, definitions and abbreviations	6
2.0	APPARECCHIATURA SOTTOPOSTA A TEST/ DEVICE UNDER TEST	7
3.0	ANTENNA REQUIREMENT - CONDIZIONI DI PROVA / TEST CONDITIONS	9
4.0	BANDWIDTH OF EMISSION (-20DB BANDWIDTH) - CONDIZIONI DI PROVA / TEST CONDITIONS	10
4.1	Apparecchiature utilizzate / Test Equipment Used – Bandwidth of emission (-20dB Bandwidth)	10
4.2	Schema del setup / Test setup diagram – Bandwidth of emission (-20dB Bandwidth)	11
4.3	Requisiti / Requirements - Bandwidth of emission (-20dB Bandwidth)	11
4.4	Risultati / Results - Bandwidth of emission (-20dB Bandwidth)	11
4.4.1	Grafici dei dati di prova / Graphical representation data - Bandwidth of emission (-20dB Bandwidth)	12
5.0	FREQUENCY STABILITY - CONDIZIONI DI PROVA / TEST CONDITIONS	13
5.1	Apparecchiature utilizzate / Test Equipment Used – Frequency Stability	13
5.2	Schema del setup / Test setup diagram – Frequency Stability	14
5.3	Requisiti / Requirements - Frequency Stability	14
5.4	Risultati / Results - Frequency Stability	14
5.4.1	Tabelle e grafici dei risultati / Tables and graphical representation of data – Frequency Stability	15

6.0	CONDUCTED EMISSION - CONDIZIONI DI PROVA / TEST CONDITIONS	16
6.1	Apparecchiature utilizzate / Test Equipment Used – Conducted emission	16
6.2	Schema del setup / Test setup diagram – Conducted emission	17
6.3	Requisiti / Requirements - Conducted emission	17
6.4	Risultati / Results - Conducted emission	18
6.4.1	Grafici dei risultati / Graphical representation data – Conducted emission	18
7.0	SPURIOUS RADIATED EMISSIONS AND OPERATION WITHIN THE BAND 13.110-14.010 MHZ - CONDIZIONI DI PROVA / TEST CONDITIONS	22
7.1	Apparecchiature utilizzate / Test Equipment Used – Spurious Radiated Emissions and Operation within the band 13.110-14.010 MHz	23
7.2	Schema del setup / Test setup diagram – Spurious Radiated Emissions and Operation within the band 13.110-14.010 MHz	24
7.3	Requisiti / Requirements - Spurious Radiated Emissions and Operation within the band 13.110-14.010 MHz	25
7.4	Risultati / Results - Spurious Radiated Emissions and Operation within the band 13.110-14.010 MHz	25
7.4.1	Tabelle e grafici dei risultati / Tables and graphical representation data – Spurious Radiated Emissions and Operation within the band 13.110-14.010 MHz	26
7.4.1.1	Operation within the band 13.110-14.010 MHz (15.225 (a), (b) and (c))	26
7.4.1.2	Spurious Radiated Emissions (15.225 (d) and 15.209)	28
	Allegato 1 / Annex 1: Incertezza / Uncertainty	38

1. Informazioni Generali / General Information

1.0 Laboratorio / Testing Laboratory

Luogo di Prova e partecipanti/ Testing location and participants:	
Testing Laboratory:	
Testing location/ address.....:	Emilab Srl a Socio Unico Via F.lli Solari 5/A – 33020 Amaro (UD) – Italy Tel +39 0433 468625 Fax +39 0433 494739 Email: info@emilab.it
Partecipanti / Participants:	/

1.1 Campionamento e Documentazione / Sampling and Documentation

I campioni sono stati consegnati dal Cliente. I risultati dei test contenuti in questo documento si riferiscono esclusivamente al modello e numero di serie provato. E' responsabilità del costruttore assicurare che la produzione dei modelli in serie rispetti i requisiti del presente documento. Questo documento non può essere riprodotto in parte senza il consenso scritto del responsabile del laboratorio EMILAB.

EMILAB non si assume nessuna responsabilità per danni derivanti da interpretazioni che esulano dal contesto e dall'applicazione del presente documento.

The samples were delivered by customer. The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report. This report shall not be reproduced, except in full, without the written approval of the Issuing testing Emilab laboratory.

EMILAB takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

1.2 Specifiche del test / Test specifications

Test performed according to:	
Test plan	TP-17LA00054_170110_BV1000CL Date: 10/01/2017 Author: Mauro Bettiga – Globalcom Engineering S.p.A.
Test specification	FCC CFR 47 - Part 15: 2017 (Subpart C) Code of Federal Regulations – Telecommunications Federal Communications Commission Radio Frequency Devices; Intentional Radiators Revised as of January 26, 2017;
Test Method/Basic Standard	FCC CFR 47 - Part 2 and Part 15: 2015 (Subpart B e C) Methods of Measurements of Conducted and Radiated Radio Noise Emissions (9kHz-18GHz) ANSI C63.4: 2014 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9KHz to 40GHz. ANSI C63.10: 2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.3 Svolgimento dei test e condizioni generali / *Test scheduling and general condition*

Svolgimento dei test/ Scheduling	
Data ricezione EUT	
<i>Date of receipt of EUT</i>	13/01/2017
Data esecuzione test	
<i>Date (s) of performance of tests</i>	02/02/2017 – 02/03/2017
Condizioni ambientali <i>/ Environment Conditions</i>	Se non diversamente specificato / <i>If not otherwise specified:</i> Temperature: 18-28°C Humidity: 20-90% Pressure: 87-108.56 kPa
Intervallo delle tarature/ <i>Calibration Interval</i>	Minimum 1 year

1.4 Espressione dei risultati finali / *Test case of final verdicts*

I GIUDIZI NON SONO SOGGETTI AD ACCREDITAMENTO <i>/ VERDICTS ARE NOT SUBJECT TO ACCREDITATION</i>	
- test case does not apply to the test object.. :	N/A
- test object does meet the requirement	Compliant or PASS
- test object does not meet the requirement . :	Not Compliant or FAIL

1.5 Incertezza / *Uncertainty*

L'incertezza estesa riportata è espressa come l'incertezza tipo moltiplicata per il fattore di copertura $k = 2$, che per una distribuzione normale corrisponde ad una probabilità di copertura di circa il 95 %.
<i>The reported expanded uncertainty of measurements is stated as the standard uncertainty of measurement, multiplied by the coverage factor $k=2$, which for a normal distribution corresponding to a coverage probability of approximately 95%.</i>

1.6 Termini, Definizioni e Acronimi/ Terms, definitions and abbreviations

AC	Alternating Current
ACK	Acknowledgement
AFH	Adaptive Frequency Hopping
AM	Amplitude modulation
AVE det	Average Detector
BIT	Burst Interval Time
CAC	Channel Availability Check
BW	BandWidth
CCA	Clear Channel Assessment
CW	Continuous Wave
DAA	Detect And Avoid
DC	Duty Cycle DFS
DFS	Dynamic Frequency Selection
DSSS	Direct Sequence Spread Spectrum
DUT	Device Under Test
e.i.r.p.	equivalent isotropically radiated power
e.r.p.	effective radiated power
EMC	Electro Magnetic Compatibility
EUT	Equipment Under test
FAR	Fully Anechoic Room
FHSS	Frequency Hopping Spread Spectrum
HT20 High	Throughput in a 20 MHz channel
HT40 High	Throughput in a 40 MHz channel
ISM	Industrial, Scientific and Medical
LBT	Listen Before Talk
LPDA	Logarithmic Periodic Dipole Antenna
MCS	Modulation Coding Scheme
MIMO	Multiple Input, Multiple Output
MU	Medium Utilisation
MS/s	Mega-Samples per second
NACK	Not Acknowledged
OATS	Open Air Test Site
OFDM	Orthogonal Frequency Division Multiplexing
OM	Operating Modes
OOB	Out Of Band
PK det	Peak Detector
PM	pulse modulation
Ppm	parts per million
PPS	Pulses Per Second
PRF	Pulse Repetition Frequency
RBW	Resolution BandWidth
RE	Radiated Emission
RMS	Root Mean Square
RF	Radio Frequency
Rx	Receiver
SAC	Semi Anechoic Chamber
TL	Threshold Level
TPC	Transmit Power Control
Tx	Transmitter
VBW	Video BandWidth
VSWR	Voltage Standing Wave Ratio

2.0 Apparecchiatura sottoposta a test/ Device Under Test

Descrizione/ Description	Contactless Unattended Reader card reader
Marchio commerciale / Trade Mark	
Produttore / Manufacturer	Globalcom Engineering S.p.A.
Modello / Model/Type reference	BV1000CL
Voltage/Current	12VDC, max 400mA
Frequency	/
Power	/
Numero EUT / EUT Number	17LA00054/01
Serial Number	07UTA
FCC ID	2AKMTBV1000CL184A
Numero di campioni testati / Number of samples tested	1
Hardware stage/level	/
Software stage/level	/
Modification stage	/
Operating Mode	Mode 1: the EUT is powered at 12V DC by the AC/DC adapter model 9820A (the AC/DC adapter model 9820A was powered at 120V 60Hz by the AC power supply unit KBT-100-C-109-451). The EUT, transmits continuously at 13.56MHz, communicates to a PC through "Hyper Terminal" software (generation of random numbers) and communicates through Ethernet to the PC using the prompt packages Command "ping -n 1000 192.168.50.2". On the micro USB port is connected a USB pendrive.
Wiring harness	1.6mt power supply cable, 2mt Ethernet cable, 2mt RS232 cable.
Monitoring	/

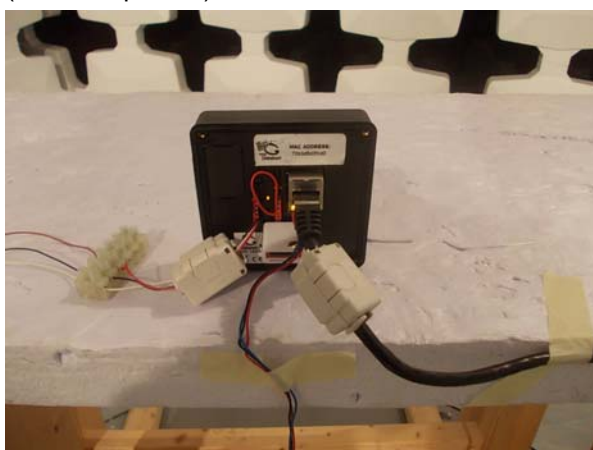
Info:

EUT Hardware features

- **Processors:** BV1000CL has two processors. One is a secure processor, high performance, low power consumption, compliant with the main security standards.
Main peripherals of the secure processor are a Memory Protection Unit (MPU), an advanced crypto multiplier for cryptography and authentication, a true random number generator, dedicated hardware for protection against SPA/DPA attacks and sensors to warranty the environment protection.
The second processor is a high-performance ARM Cortex™-M4 32-bit RISC core operating at a frequency up to 168 MHz with memory protection unit (MPU) which enhances application security.
- **Contactless Chip Driver:** it's CLRC663 chip from NXP.
The CLRC663 is a highly integrated transceiver IC for contactless communication at 13.56 MHz. This transceiver IC uses an outstanding modulation and demodulation concept completely integrated for different kinds of contactless communication methods and protocols at 13.56 MHz. CLRC663 is connected to cortex M4 processor on a Serial Peripheral Interface (SPI).
- ARCHITECTURE: Dual ARM Processor 32 bit
- MEMORY: 512K internal flash ,8MByte NOR FLASH, 4MByte PSRAM, 8+4MB dataflash
- LEDS: 4 green leds for contactless transaction status 1 RGB led for device status
- BUZZER: Magnetic buzzer
- CONTACTLESS DRIVER: CLRC663
- SAM READER: 2 SAM module connectors
- COMMUNICATION: 4 RS-232 serial ports, 1 USB 2.0 OTG, 1 Ethernet 10/100MB.
- POWER SUPPLY: DC from 8V to 30V
- POWER CONSUMPTION: 4W Max
- BATTERY BACK-UP: Primary Lithium
- ENCRYPTING: AES 128, TDES
- BOOTING TIME: 700 mS

EUT modifications at manufacturer's care:

- The Spurious Radiated Emissions test was performed with two ferrites Wurth model 74272733, the first one placed on RS232 cable and the second one placed on Ethernet cable, near to the EUT (see next picture);



Auxiliary equipment for tests

- Personal Computer Hewlett/Packard, model 6715s;
- AC/DC Adapter Nordic Power, model 9820A;

3.0 Antenna Requirement - Condizioni di prova / Test Conditions

Technician / Tecnico: Loris Fruch		
Table No.	TEST: Antenna Requirement, FCC Part 15 Section 15.203	\
Method	FCC CFR 47 - Part 2 and Part 15: 2015 (Subpart B e C)	\
Parameters required prior to the test	Laboratory Ambient Temperature	18 to 28 °C
	Relative Humidity	20 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	20 °C
	Relative Humidity	60 %
Supplementary information: - 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. - Assessment: the EUT has one integral antenna arrangement, which was permanently attached and fulfill the requirement of this section. Please refer to the EUT photos. Result: PASS;		

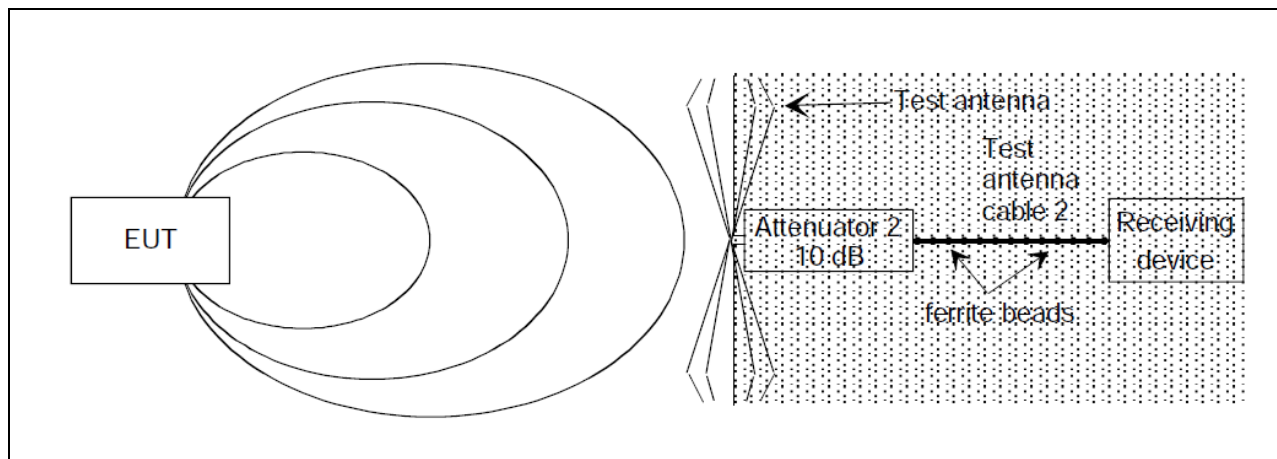
4.0 Bandwidth of emission (-20dB Bandwidth) - Condizioni di prova / Test Conditions

Technician / Tecnico: Loris Fruch		
Table No.	TEST: 20 dB Emission Bandwidth, FCC Part 15 Section 15.215 (c)	\
Method	FCC CFR 47 - Part 2 and Part 15: 2015 (Subpart B e C) ANSI C63.10: 2013, Par. 6.9.2	\
Parameters required prior to the test	Laboratory Ambient Temperature	18 to 28 °C
	Relative Humidity	20 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	20 °C
	Relative Humidity	59 %
Supplementary information: - EUT Operating Mode: Mode1 (see par. 2.0); - The measures were performed with the EUT powered at 12V DC by the AC/DC adapter model 9820A; - Test site: SAC (Semi-anechoic chamber); - The EUT was placed on turn-platform on a dielectric support of 0.8m height (above the ground plane). - The EUT was placed 3m apart from the receiving antenna; - EUT oriented at 180 degree and receiving antenna 1mt height (the EUT orientation and the antenna height were the same that correspond to the maximum emission registered during the Radiated Emission test of par.7); - Spectrum analyser settings: • Span: 40kHz • Resolution bandwidth (BW): 1KHz • Video bandwidth (VBW): 3kHz • Sweep time: 10ms • Detector: Peak • Trace: Max hold • Attenuation: 10dB - Limits: 20dB below peak output power;		

4.1 Apparecchiature utilizzate / Test Equipment Used – Bandwidth of emission (-20dB Bandwidth)

Apparecchiature usate/Equipment Used	Modello/Model	Costruttore/Manufacturer	Numero di serie/Serial Number	Data calibrazione / Calibration date	Intervallo / Interval
EMI Receiver	ESW44	Rohde&Schwarz	101546	10/2016	1 year
Loop Antenna	6502	ETS-Lindgren	00164807	06/2016	1 year
RF Cable	S5LL-400	Spin electronics	01-053-12	03/2016	1 year
RF Cable	S5LL-900	Spin electronics	02-053-12	03/2016	1 year
AC Power Supply	KBT-100-C-109-451	BEHLMAN	5896	12/2016	1 year
Multi-Device Controller	2090	ETS-Lindgren	81311	-	-
Antenna Mast	2175	ETS-Lindgren	136028	-	-
Semi-Anechoic Chamber	-	ETS-Lindgren	5207	-	-

4.2 Schema del setup / Test setup diagram – Bandwidth of emission (-20dB Bandwidth)



4.3 Requisiti / Requirements - Bandwidth of emission (-20dB Bandwidth)

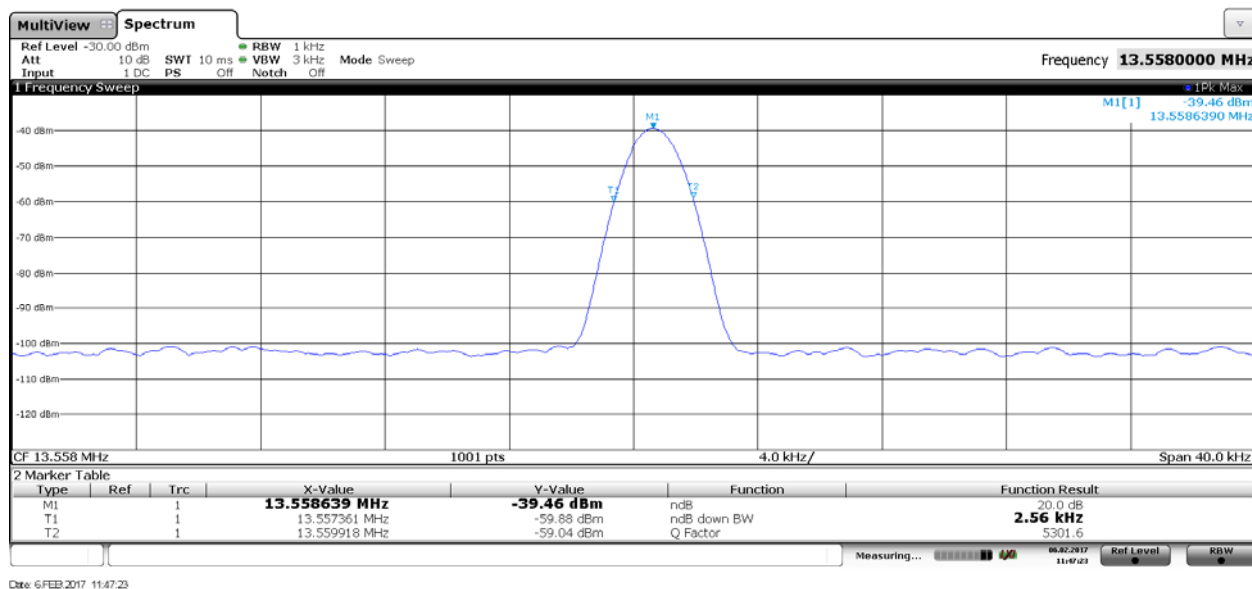
FCC Section 15.215 (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

4.4 Risultati / Results - Bandwidth of emission (-20dB Bandwidth)

The EUT meets the requirements of the section 15.215 (c) of FCC Part 15 Subpart C, than the result of the test is: **PASS**.

Channel (No.)	Frequency (kHz)	Channel Bandwidth (kHz)
01	13.559	2.56

4.4.1 Grafici dei dati di prova / Graphical representation data - Bandwidth of emission (-20dB Bandwidth)



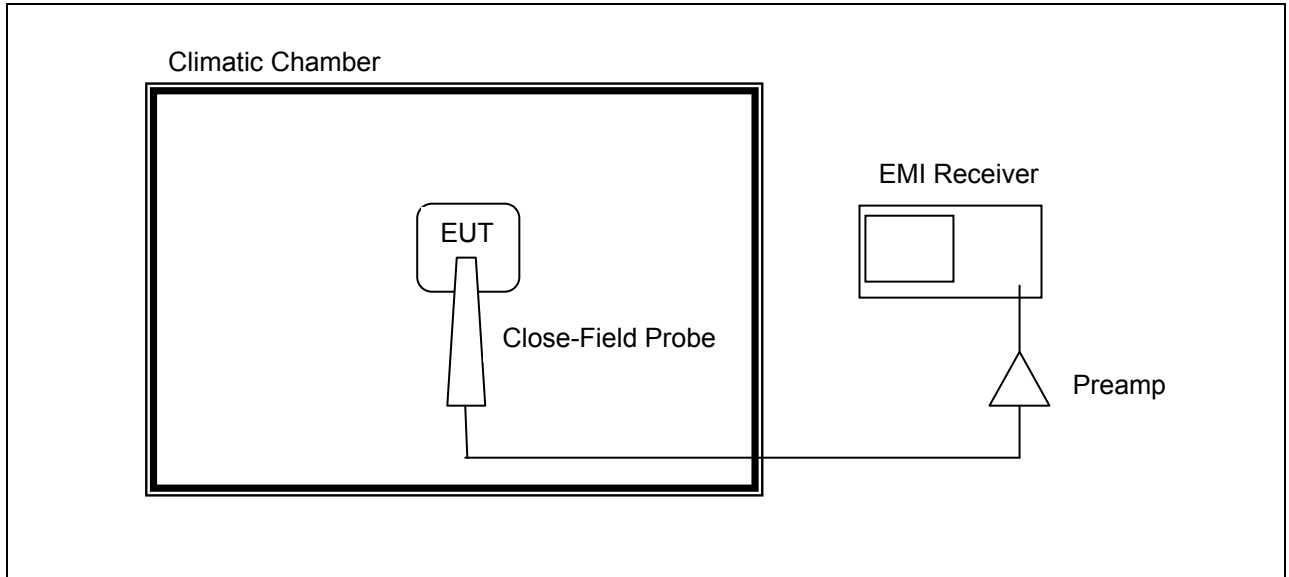
5.0 Frequency Stability - Condizioni di prova / Test Conditions

Technician / Tecnico: Loris Fruch		
Table No.	TEST: Frequency tolerance of the carrier signal, FCC Part 15 Section 15.225 (e);	
Method	FCC CFR 47 - Part 2 and Part 15: 2015 (Subpart B e C)	
Parameters required prior to the test	Laboratory Ambient Temperature	18 to 28 °C
	Relative Humidity	20 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	23 °C
	Relative Humidity	60 %
Supplementary information:		
- EUT Operating Mode: Mode1 (see par. 2.0); - During the test the EUT was powered at 12V DC by the AC/DC adapter model 9820A; - The EUT was placed in a temperature chamber with all other equipment outside at room temperature. Sufficient time was allowed to stabilize the unit after the chamber reached the desired temperature (1hour). Data was taken in 10 degree steps from -20°C to +50°C; - The measures were performed with the AC/DC adapter powered at nominal voltage of 120V/60Hz; - The measures at 20°C were performed also with the AC/DC adapter powered at 85% and 115% of 120Vac nominal power supply voltage; - Spectrum analyzer settings setup: • Detector: Peak • RBW: 1KHz, VBW=1kHz, SPAN: 10KHz • Reference Level: 0 dBm, Display Mode: 10 dB/div • Input Attenuation: 10 dB		

5.1 Apparecchiature utilizzate / Test Equipment Used – Frequency Stability

<i>Apparecchiature usate/Equipment Used</i>	<i>Modello/Model</i>	<i>Costruttore/Manufacturer</i>	<i>Numero di serie/Serial Number</i>	<i>Data calibrazione / Calibration date</i>	<i>Intervallo / Interval</i>
EMI Receiver MXE	N9038A	Agilent	MY51210230	06/2016	1 year
Close-Field Probe	11941A	Hewlett/Packard	2807A05682	Verified before use	-
RF Cable	RG142B/U	CPE Italia Spa (CPE)	EL089516	07/2016	1 year
Data Logger USB TC	OM-EL-USB-TC-LCD	Omega Engineering	10033112	06/2016	1 year
Climatic Chamber	KJ-2091 A	Dongguan Kejian Instrument Co.,Ltd	16-15	06/2016	1 year
AC Power Supply	KBT-100-C-109-451	BEHLMAN	5896	12/2016	1 year

5.2 Schema del setup / Test setup diagram – Frequency Stability



5.3 Requisiti / Requirements - Frequency Stability

FCC Section 15.225(e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+ 50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.4 Risultati / Results - Frequency Stability

The measured frequencies are inside the limits than the result of the test is: **PASS**. See the details in the table of the following paragraphs (see the worst case in bold text).

5.4.1 Tabelle e grafici dei risultati / *Tables and graphical representation of data – Frequency Stability*

$f_0 = 13,559 \text{ MHz}$					
Temperature (°C)	Supply voltage	Measured Frequency (MHz)	Frequency Error (%)	Limit (±%)	Result
-20	120V / 60Hz	13,558830	0,00094	0,01	Pass
-10	120V / 60Hz	13,558807	0,00077	0,01	Pass
0	120V / 60Hz	13,558777	0,00055	0,01	Pass
10	120V / 60Hz	13,558744	0,00030	0,01	Pass
20	100V / 60Hz	13,558708	0,00004	0,01	Pass
20	120V / 60Hz	13,558703	0,00000	0,01	Reference Value
20	140V / 60Hz	13,558702	-0,00001	0,01	Pass
30	120V / 60Hz	13,558692	-0,00008	0,01	Pass
40	120V / 60Hz	13,558696	-0,00005	0,01	Pass
50	120V / 60Hz	13,558715	0,00009	0,01	Pass

6.0 Conducted emission - Condizioni di prova / Test Conditions

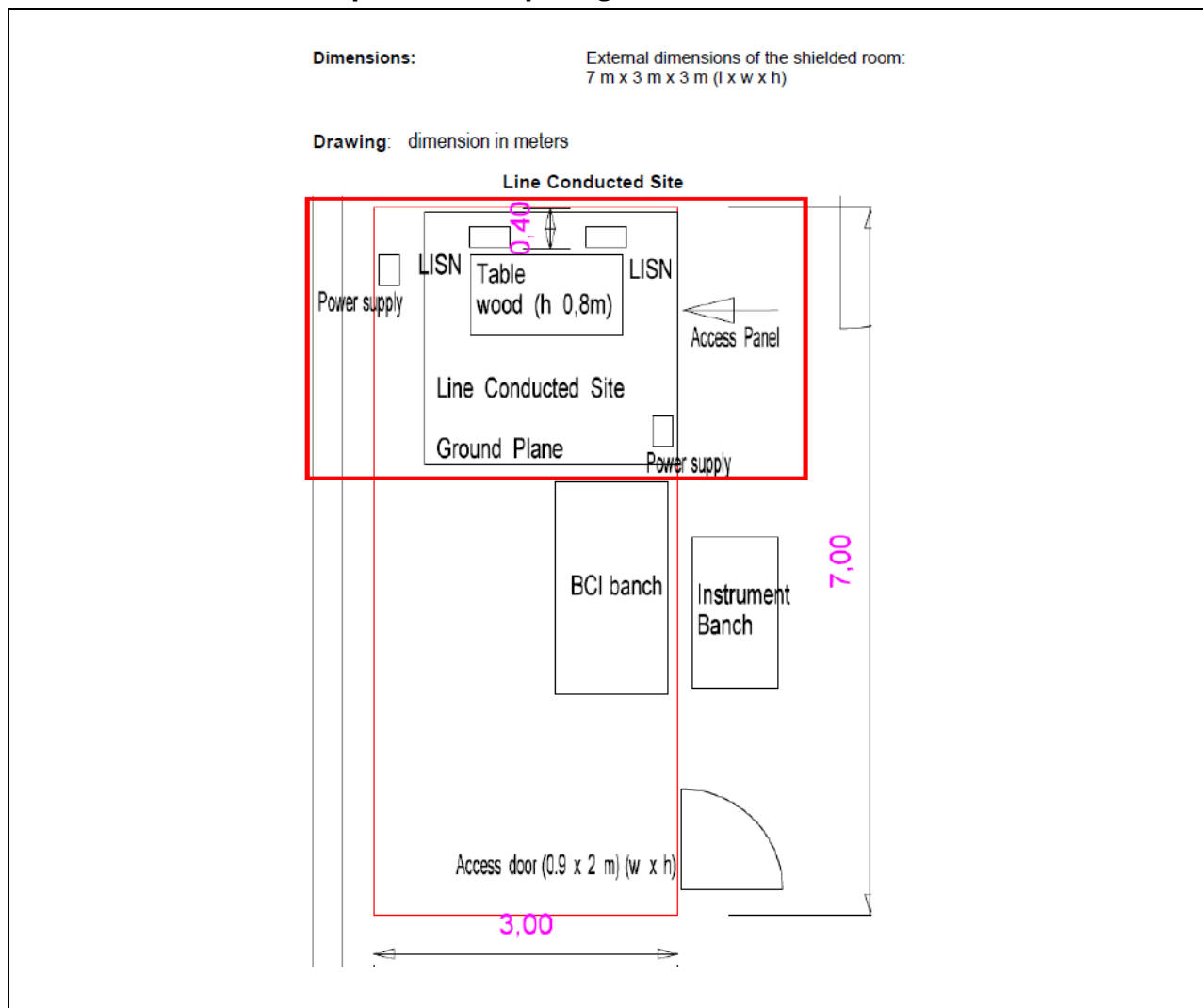
Technician / Tecnico: Loris Fruch		
Table No.	TEST: AC Power Line Conducted Emissions, FCC Part 15 Section 15.207	\
Method	FCC CFR 47 - Part 2 and Part 15: 2015 (Subpart B e C) ANSI C63.10: 2013, Par. 6.2 ANSI C63.4: 2014, Par. 7	\
Parameters required prior to the test	Laboratory Ambient Temperature	18 to 28 °C
	Relative Humidity	20 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C
	Relative Humidity	44 %
Fully configured sample scanned over the following frequency range	150kHz to 30MHz	
Supplementary information:		
- EUT Operating Mode: Mode 1 (see par. 2.0); - During the test the EUT was powered at 12V DC by the AC/DC adapter model 9820A; - The test was performed on 120V 60Hz power supply line of the AC/DC adapter;		

6.1 Apparecchiature utilizzate / Test Equipment Used – Conducted emission

Apparecchiature usate/Equipment Used	Modello/Model	Costruttore/Manufacturer	Numero di serie/Serial Number	Data calibrazione / Calibration date	Intervallo / Interval
EMI Receiver	ESW44	Rohde&Schwarz	101546	10/2016	1 year
LISN	NSLK 8128	Schwarzbeck	8128-336	09/2016	1 year
Cable RF	Aircell 7	Hewlett/Packard	-	06/2016	1 year
Cable RF	SLULL18-NMNM-4.00M	Timesmicrowave	07035-001-001	07/2016	1 year
Shielded Chamber	RFD-100	ETS-Lindgren	2012	-	-
Shielded Chamber DC Filter	N5004	ETS-Lindgren	121226	-	-
AC Power Supply	KBT-100-C-109-451	BEHLMAN	5896	12/2016	1 year

Software	Revisione/Revision	Costruttore/Manufacturer	Intervallo Verifica/Verification Interval
Integral EMI/EMC measurement software	RadiMation Version 2016.1.3	DARE Instruments	1 year

6.2 Schema del setup / Test setup diagram – Conducted emission



6.3 Requisiti / Requirements - Conducted emission

FCC Section 15.207(a) 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 ohms 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.

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

*Decreases with the logarithm of the frequency.

6.4 Risultati / Results - Conducted emission

The result of the test is: **PASS**. See the details in the charts of the following paragraphs.

Worst-case emission detected:

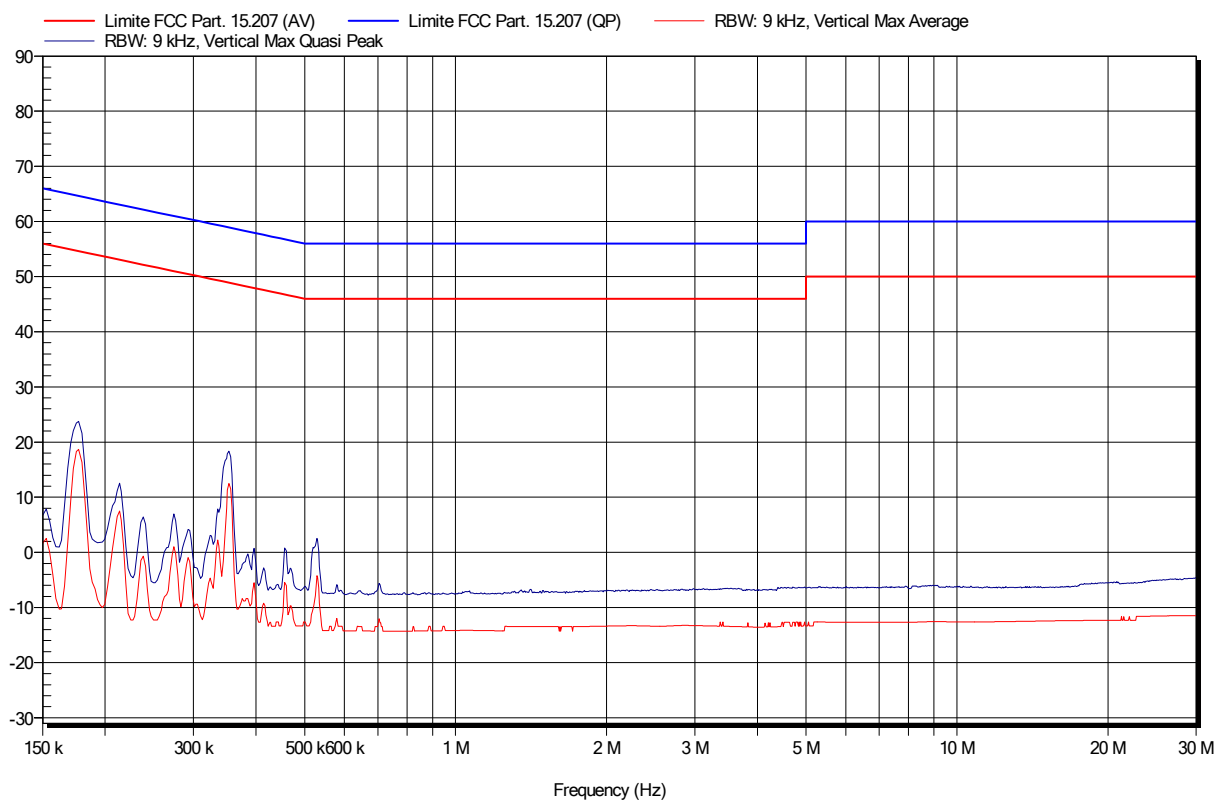
Frequency (MHz)	Quasi-peak Measure (dB μ V)	Quasi-peak Limit (dB μ V)	Quasi-peak Difference from limit (dB)	Result
0,152	58,0	65,9	-7,8	Pass

Frequency (MHz)	Average Measure (dB μ V)	Average Limit (dB μ V)	Average Difference from limit (dB)	Result
29,935	35,7	50,0	-14,3	Pass

6.4.1 Grafici dei risultati / Graphical representation data – Conducted emission

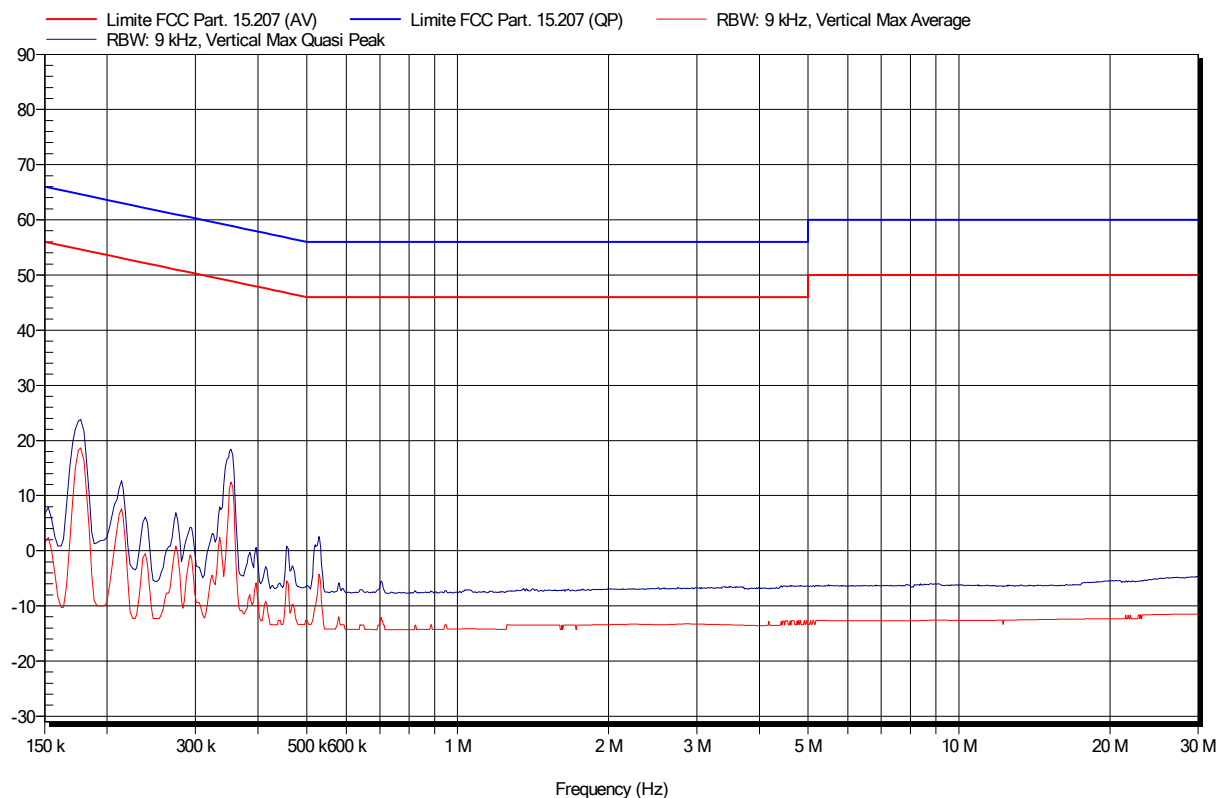
Noise floor measured on 120V/60Hz Line1 (from 0.15MHz to 30MHz): quasi-peak detector (blue trace) and average detector (red trace), with quasi-peak and average limits.

Emissions measured in dB μ V



Noise floor measured on 120V/60Hz Line2 (from 0.15MHz to 30MHz): quasi-peak detector (blue trace) and average detector (red trace), with quasi-peak and average limits.

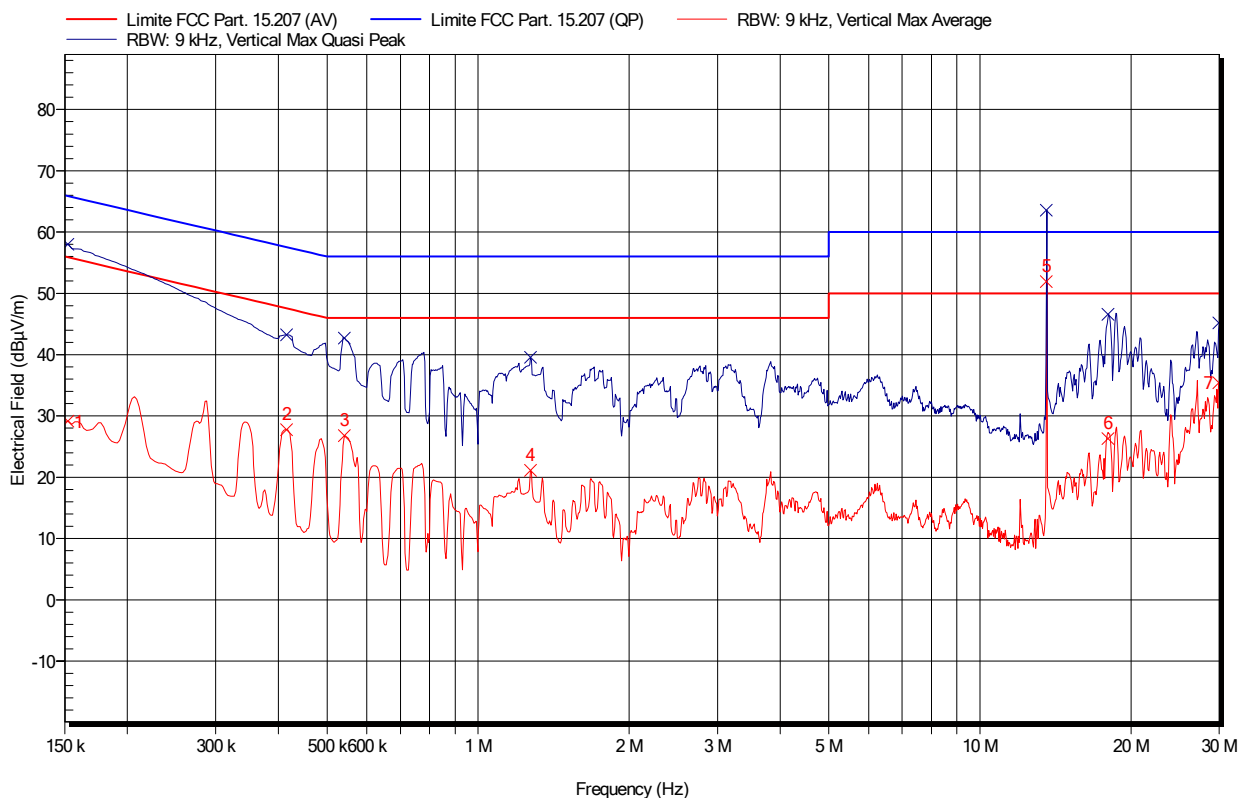
Emissions measured in dB μ V



Measure on EUT

Conducted emission measured on 120V/60Hz Line1 (from 0.15MHz to 30MHz): quasi-peak detector (blue trace) and average detector (red trace), with quasi-peak and average limits

Emissions measured in dB μ V

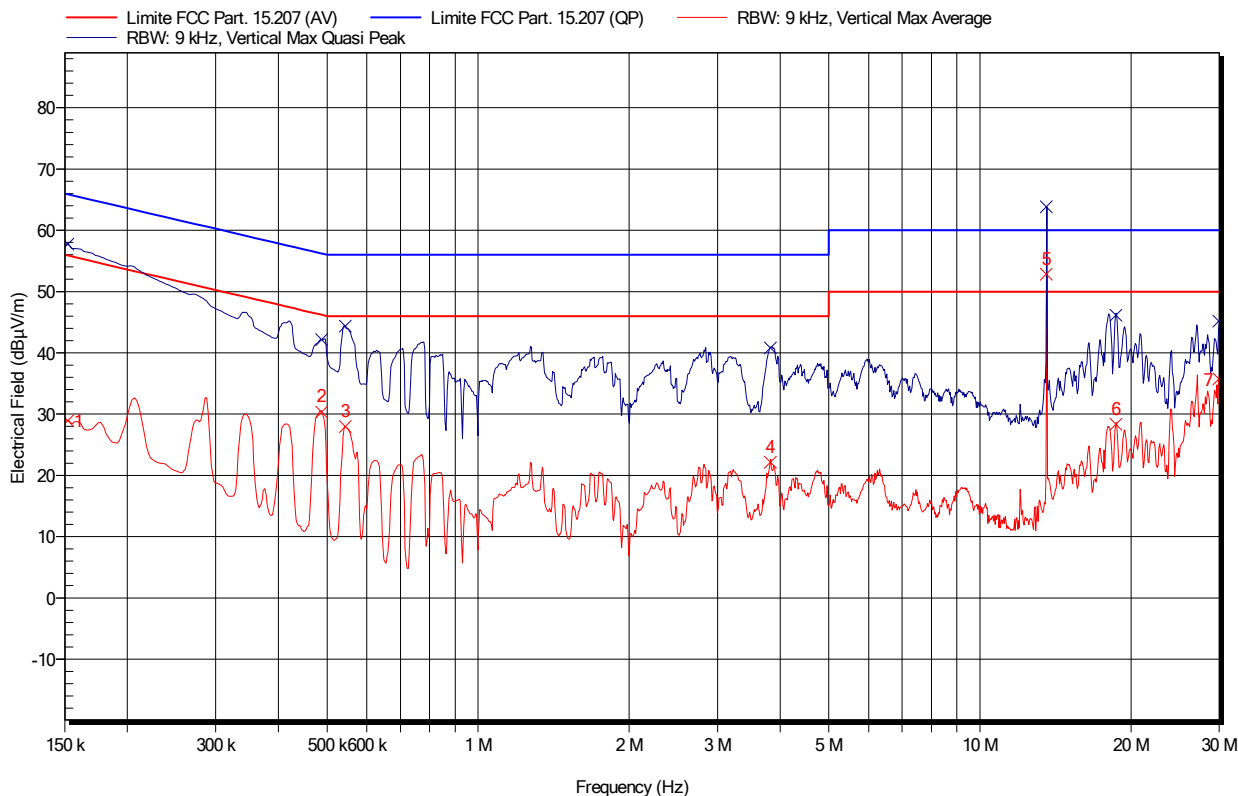


Signal list

Frequency (MHz)	Average Measure (dB μ V)	Average Limit (dB μ V)	Average Difference from limit (dB)	Quasi-peak Measure (dB μ V)	Quasi-peak Limit (dB μ V)	Quasi-peak Difference from limit (dB)	Result
0,152	29,2	55,9	-26,7	58,0	65,9	-7,8	Pass
0,416	27,7	47,5	-19,8	43,2	57,5	-14,3	Pass
0,542	26,8	46,0	-19,2	42,7	56,0	-13,3	Pass
1,272	21,1	46,0	-24,9	39,5	56,0	-16,5	Pass
13,560	51,9	50,0	1,9	63,6	60,0	3,6	Foundamental Freq.
18,001	26,3	50,0	-23,7	46,6	60,0	-13,4	Pass
29,935	35,4	50,0	-14,6	45,2	60,0	-14,8	Pass

Conducted emission measured on 120V/60Hz Line2 (from 0.15MHz to 30MHz): quasi-peak detector (blue trace) and average detector (red trace), with quasi-peak and average limits

Emissions measured in dB μ V



Signal list

Frequency (MHz)	Average Measure (dB μ V)	Average Limit (dB μ V)	Average Difference from limit (dB)	Quasi-peak Measure (dB μ V)	Quasi-peak Limit (dB μ V)	Quasi-peak Difference from limit (dB)	Result
0,152	28,9	55,9	-27,0	57,8	65,9	-8,1	Pass
0,488	30,3	46,2	-15,9	42,1	56,2	-14,1	Pass
0,544	28,0	46,0	-18,0	44,3	56,0	-11,7	Pass
3,822	22,1	46,0	-23,9	40,8	56,0	-15,2	Pass
13,560	52,8	50,0	2,8	63,8	60,0	3,8	Foundamental Freq.
18,665	28,3	50,0	-21,7	46,1	60,0	-13,9	Pass
29,935	35,7	50,0	-14,3	45,2	60,0	-14,8	Pass

7.0 Spurious Radiated Emissions and Operation within the band 13.110-14.010 MHz - Condizioni di prova / Test Conditions

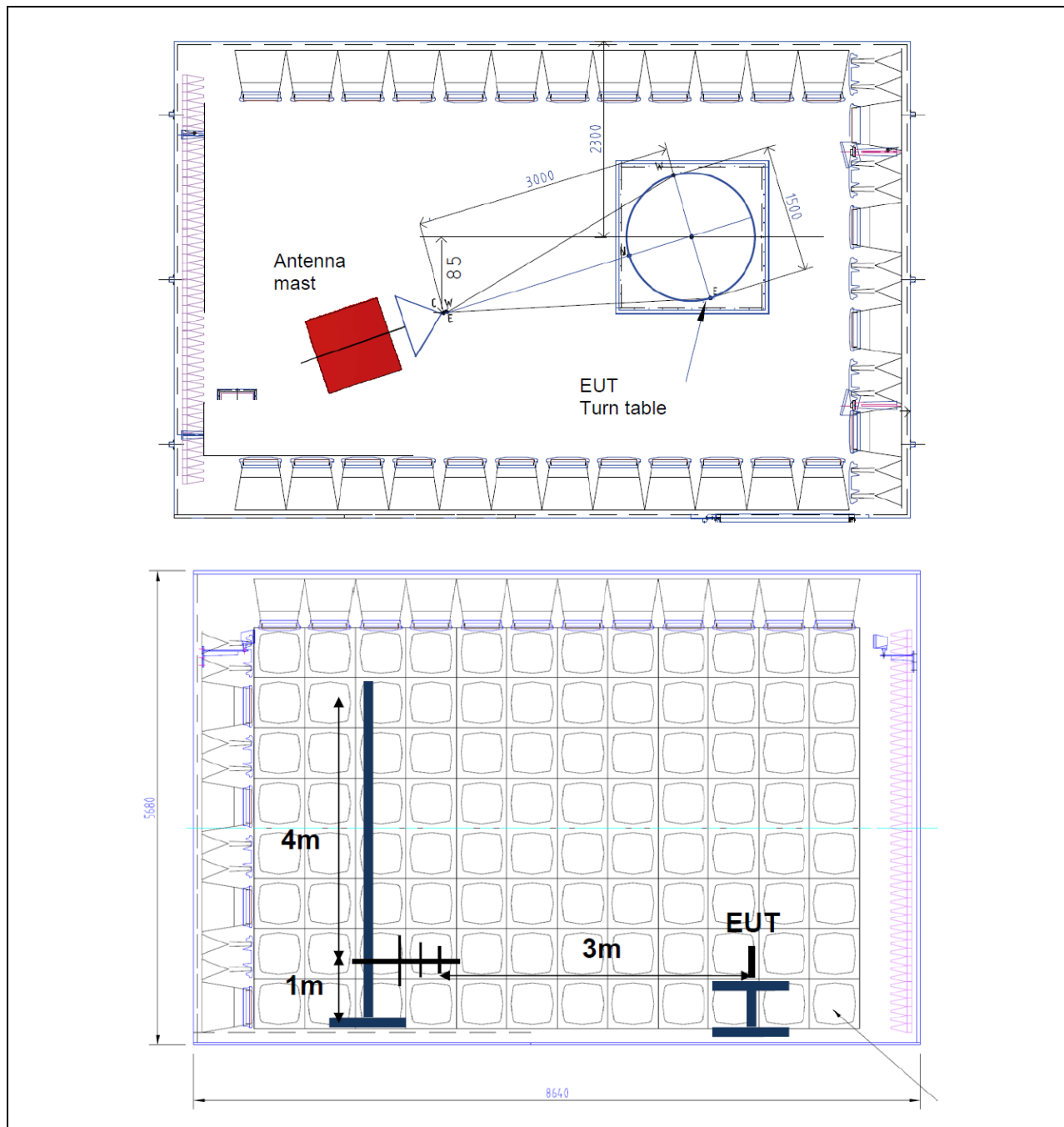
Technician / Tecnico: Loris Fruch		
Table No.	TEST: Spurious Radiated Emissions and Restricted Bands of Operation, FCC Part 15 Section 15.225 and 15.209	\
Method	FCC CFR 47 - Part 2 and Part 15: 2015 (Subpart B e C) ANSI C63.10: 2013, Par. 6.3 ANSI C63.4: 2014, Par. 8	\
Parameters required prior to the test	Laboratory Ambient Temperature	18 to 28 °C
	Relative Humidity	20 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	20-21 °C
	Relative Humidity	42-62 %
Supplementary information: - Frequency range of the measurements: up to 1GHz - During the test the EUT was powered at 12V DC by the AC/DC adapter model 9820A; - EUT Operating Mode: Mode 1 (see par. 2.0); - The EUT was placed on turn-platform on a dielectric support of 0.8m height above the ground plane; - The EUT was placed 3m apart from the receiving antenna; - The turn-platform is rotated from 0° to 360° degrees to determine the position of maximum emission level. The antenna height was changed from 1m to 4m, to find the highest emission; - The receiving antenna was positioned in horizontal and vertical polarization (by means of an automatic procedure computer assisted); - The measurements were made with the detector set to PEAK within a IF bandwidth of 200Hz from 9KHz to 150KHz and of 120KHz from 30MHz to 1GHz; - The final measurements with Quasi-Peak/AVE detector were performed at least for frequencies for which the Peak values was $\geq$ (limit – 4dB); - Antennas used during measurements: Loop antenna from 9KHz to 30MHz and Bilog antenna from 30MHz to 1GHz; - Remark: In accordance with part 15.31 (f) (2) of FCC, where the measurement distance was specified to be 30 or 300meters, 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) = $40\log(30\text{meter} / 3\text{meter}) = +40\text{dB}$		

7.1 Apparecchiature utilizzate / Test Equipment Used – Spurious Radiated Emissions and Operation within the band 13.110-14.010 MHz

<i>Apparecchiature usate/Equipment Used</i>	<i>Modello/Model</i>	<i>Costruttore/Manufacturer</i>	<i>Numero di serie/Serial Number</i>	<i>Data calibrazione / Calibration date</i>	<i>Intervallo / Interval</i>
EMI Receiver	ESW44	Rohde&Schwarz	101546	10/2016	1 year
Loop Antenna	6502	ETS-Lindgren	00164807	06/2016	1 year
Bilog Antenna	Bilog CBL6111C	Chase	2415	10/2015 09/2016 (Verification)	1 year
Pre-Amplifier	HP8447F, OPT H64	Hewlett/Packard	3113A07568	04/2016	1 year
RF Cable	S5LL-400	Spin electronics	01-053-12	03/2016	1 year
RF Cable	S5LL-900	Spin electronics	02-053-12	03/2016	1 year
RF Cable	RG142B/U	CPE Italia Spa (CPE)	EL089516	07/2016	1 year
AC Power Supply	KBT-100-C-109-451	BEHLMAN	5896	12/2016	1 year
Multi-Device Controller	2090	ETS-Lindgren	81311	-	-
Antenna Mast	2175	ETS-Lindgren	136028	-	-
Semi-Anechoic Chamber	-	ETS-Lindgren	5207	-	-

<i>Software</i>	<i>Revisione/Revision</i>	<i>Costruttore/Manufacturer</i>	<i>Intervallo Verifica/Verification Interval</i>
Integral EMI/EMC measurement software	RadiMation Version 2016.1.3	DARE Instruments	1 year

7.2 Schema del setup / Test setup diagram – Spurious Radiated Emissions and Operation within the band 13.110-14.010 MHz



7.3 Requisiti / Requirements - Spurious Radiated Emissions and Operation within the band 13.110-14.010 MHz

FCC Section 15.209 Radiated emission limits; general requirements.

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

FCC Section 15.225 Operation within the band 13.110-14.010 MHz.

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

7.4 Risultati / Results - Spurious Radiated Emissions and Operation within the band 13.110-14.010 MHz

The result of the test is: **PASS**. See the details in the charts/tables of the following paragraphs.

Level of maximum spurious detected:

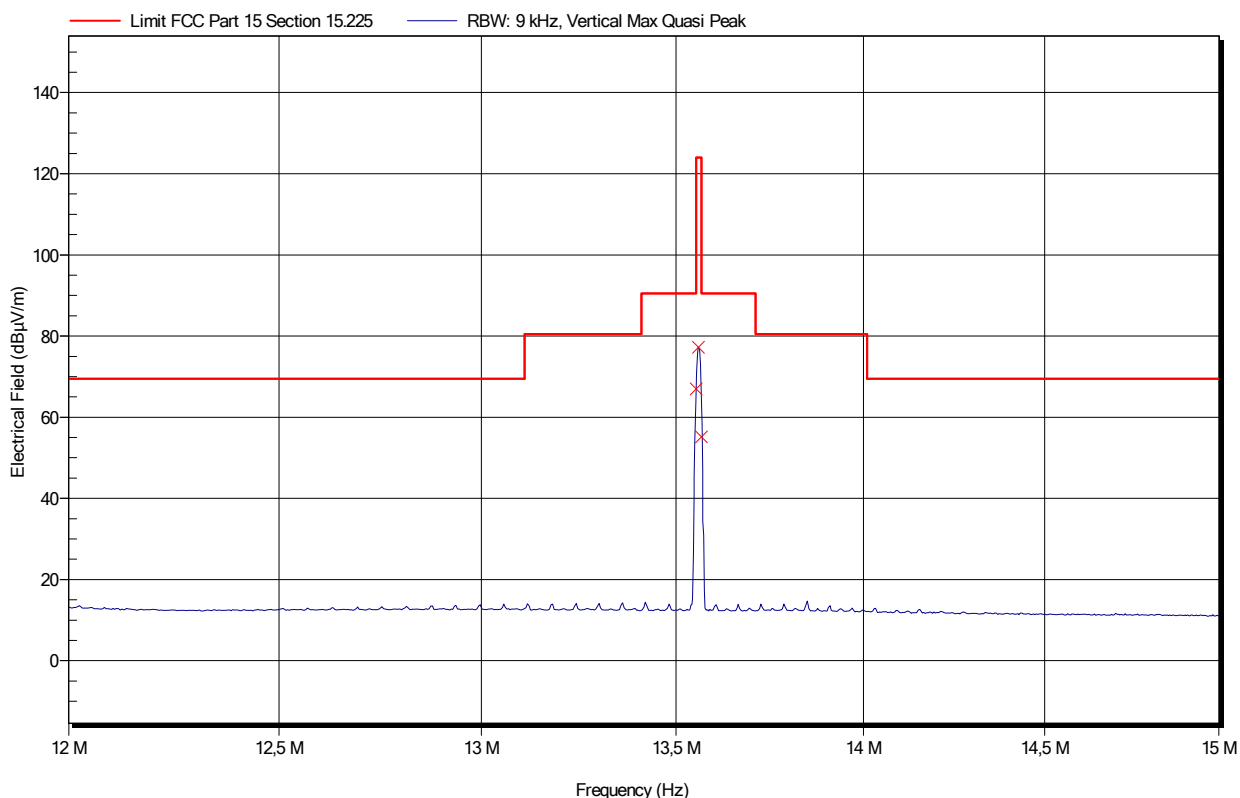
4th harmonic of fundamental frequency

Frequency [MHz]	Quasi-Peak [dBμV/m]	Quasi-Peak Limit [dBμV/m]	Difference from Limit [dBμV/m]	EUT Angle [°]	Antenna Height [mt]	Result
54,240	38,7	40,0	-1,3	270	1,00	Pass

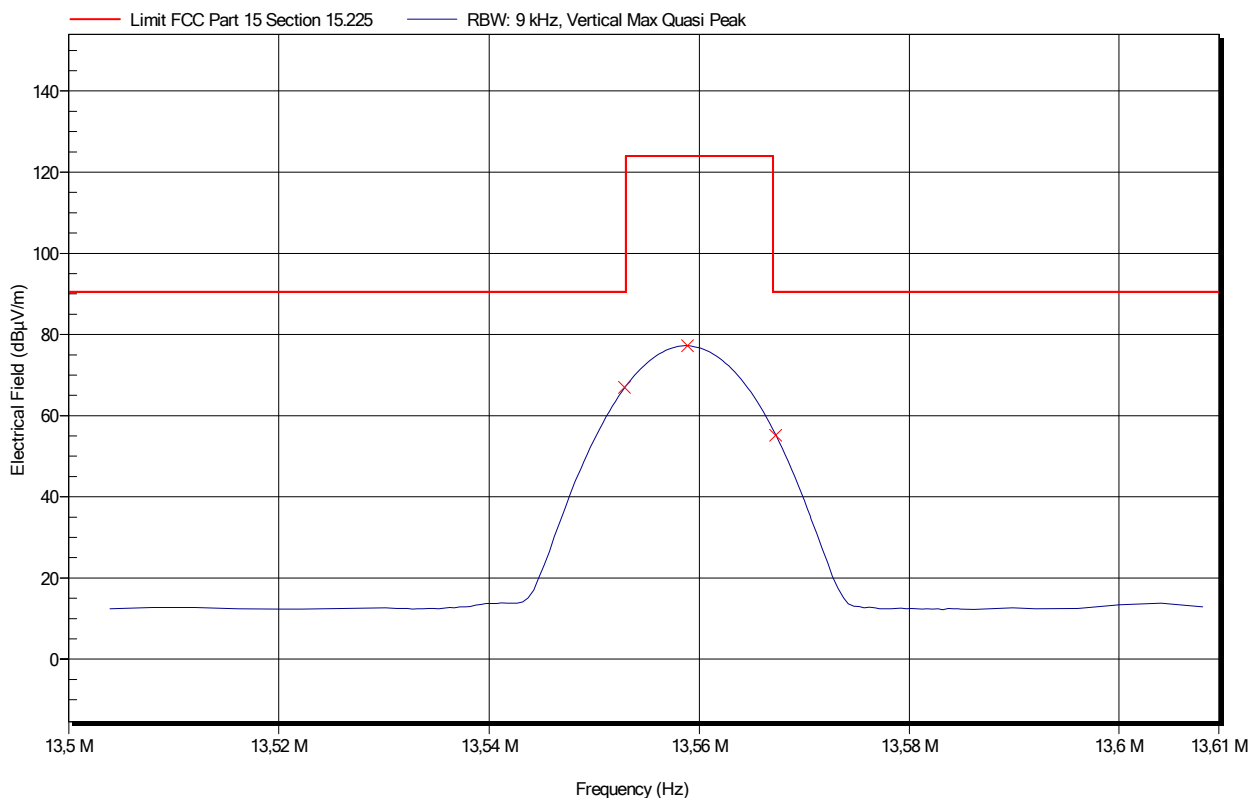
7.4.1 Tabelle e grafici dei risultati /Tables and graphical representation data – Spurious Radiated Emissions and Operation within the band 13.110-14.010 MHz

7.4.1.1 Operation within the band 13.110-14.010 MHz (15.225 (a), (b) and (c))

Radiated emissions measured from 12MHz to 15MHz. Quasi-Peak detector (blue line) with IF=9KHz. Quasi-Peak limit (red line). Antenna in vertical polarization orthogonal to the EUT axis.



Detail of emission from 13.5MHz to 13.61MHz



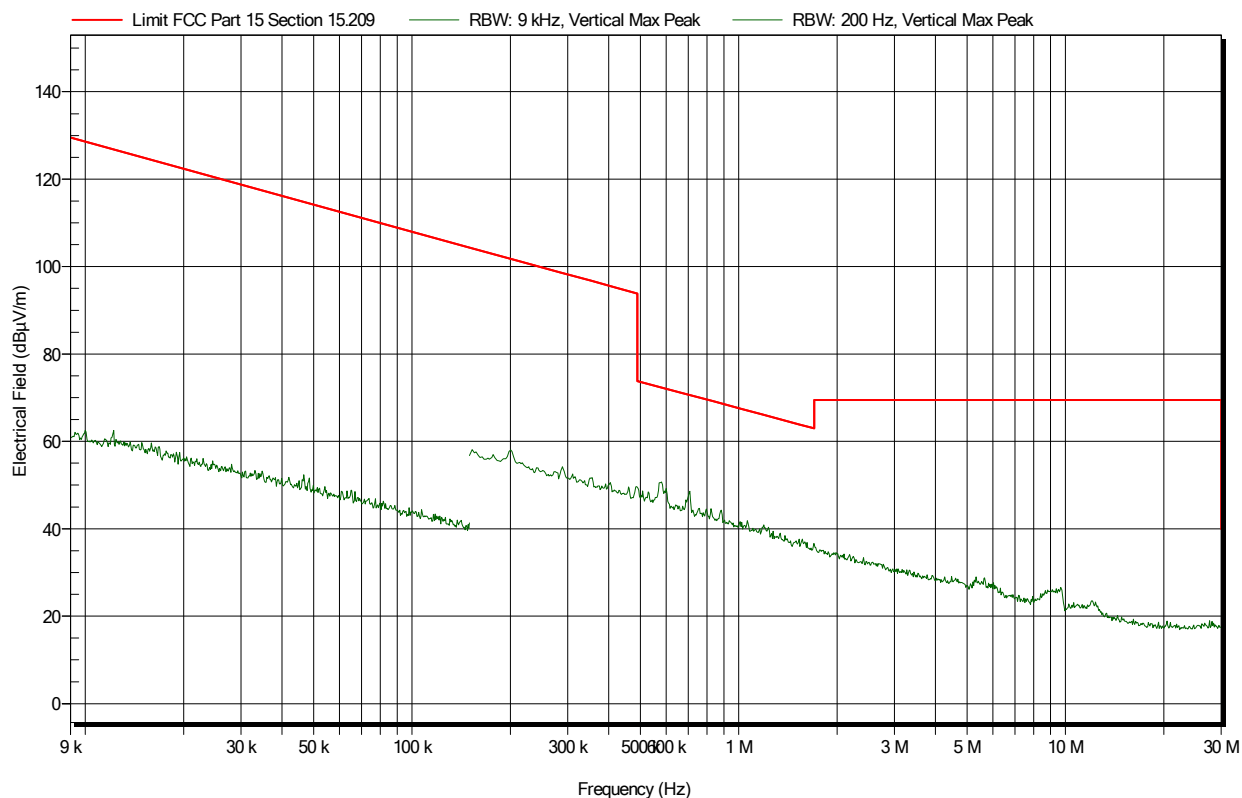
Signal list

Frequency [MHz]	Quasi-Peak [dBµV/m]	Quasi-Peak Limit [dBµV/m]	Difference from Limit [dBµV/m]	EUT Angle [°]	Antenna Height [mt]	Result
13,553	67,0	90,5	-23,5	180	1,00	Pass
13,559	77,2	124,0	-46,8	180	1,00	Pass
13,567	55,2	90,5	-35,3	180	1,00	Pass

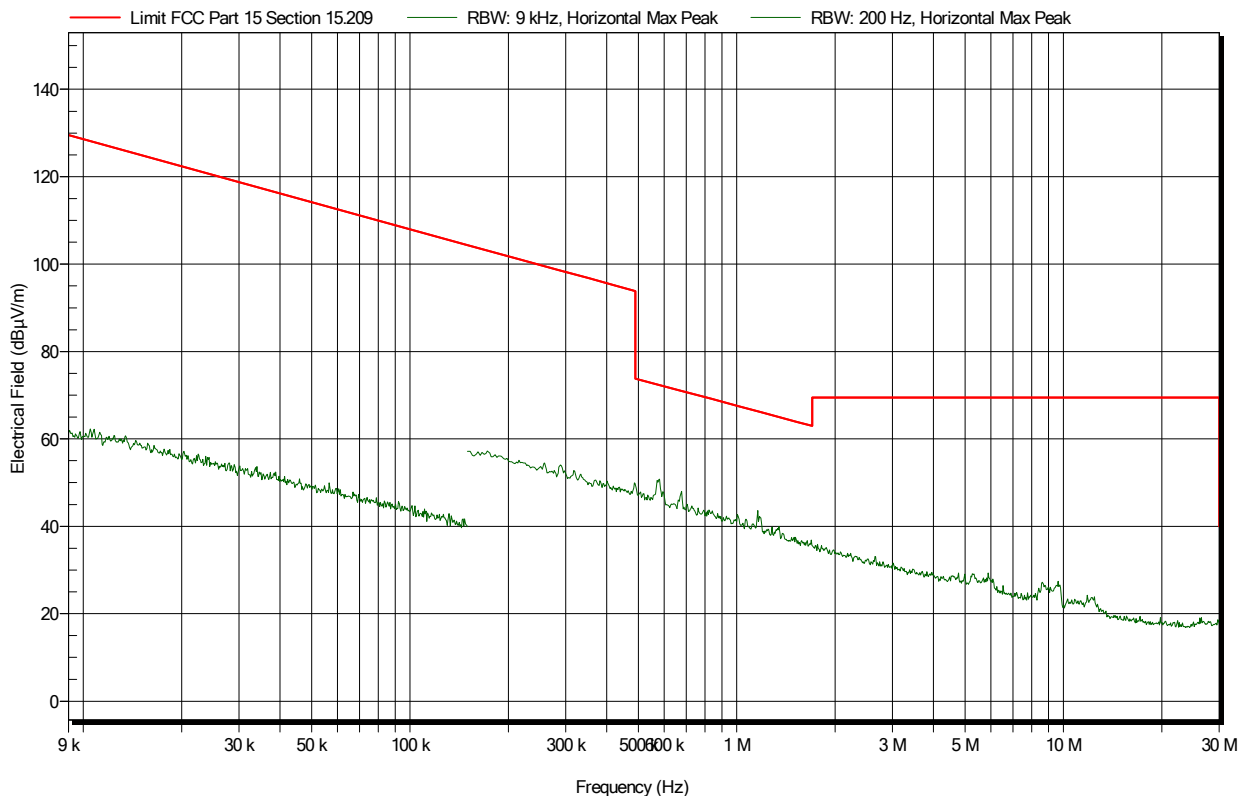
7.4.1.2 Spurious Radiated Emissions (15.225 (d) and 15.209)

Measures from 9KHz to 30MHz

Noise floor measured from 9KHz to 30MHz. Peak detector (green trace) with IF=200Hz from 9KHz to 150KHz and IF=9KHz from 150KHz to 30MHz. Q-Peak/Average limit (red line). Vertical polarization.

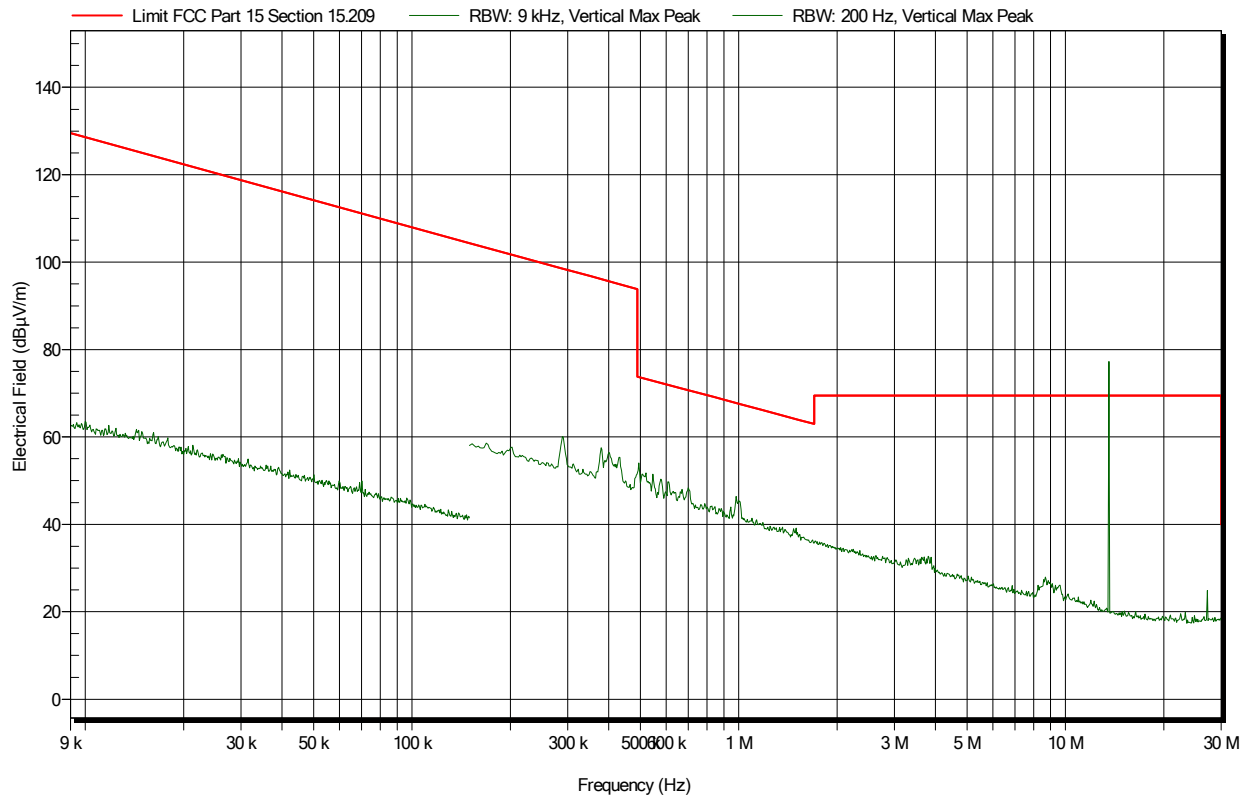


Noise floor measured from 9KHz to 30MHz. Peak detector (green trace) with IF=200Hz from 9KHz to 150KHz and IF=9KHz from 150KHz to 30MHz. Q-Peak/Average limit (red line). Horizontal polarization.



Measure on EUT

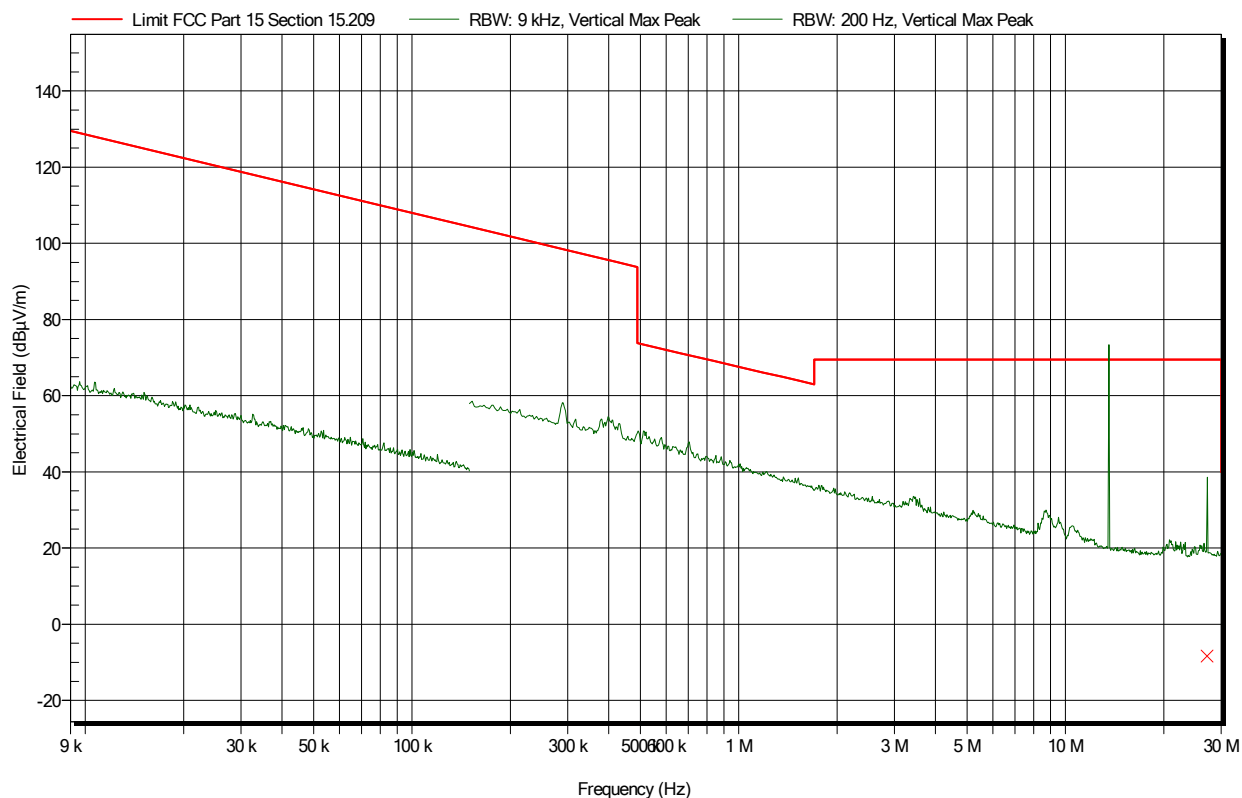
Radiated emissions measured from 9KHz to 30MHz. Peak detector (green trace) with IF=200Hz from 9KHz to 150KHz and IF=9KHz from 150KHz to 30MHz. Q-Peak/Average limit (red line). Antenna in vertical polarization orthogonal to the EUT axis.



Peak amplitude of fundamental frequency

Frequency [MHz]	Peak [dBμV/m]	EUT Angle [°]	Antenna Height [mt]
13,558	77,1	180	1,00

Radiated emissions measured from 9KHz to 30MHz. Peak detector (green trace) with IF=200Hz from 9KHz to 150KHz and IF=9KHz from 150KHz to 30MHz. Q-Peak/Average limit (red line). Antenna in vertical polarization parallel to the EUT axis.



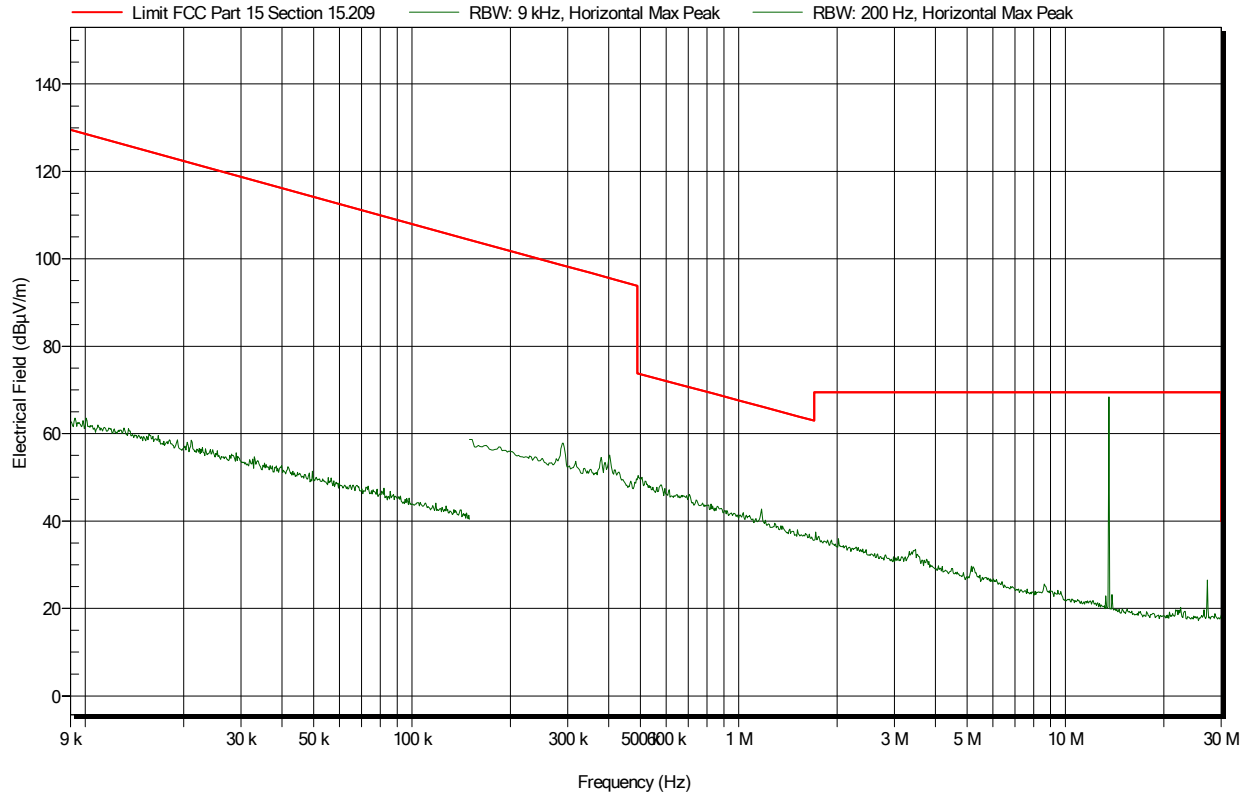
Higher signals, maximized and re-measured with quasi-peak detector

Frequency [MHz]	Quasi-Peak [dBµV/m]	Quasi-Peak Limit [dBµV/m]	Difference from Limit [dBµV/m]	EUT Angle [°]	Antenna Height [mt]	Result
27,116	-8,3	69,5	-77,8	68	1,10	Pass

Peak amplitude of fundamental frequency

Frequency [MHz]	Peak [dBµV/m]	EUT Angle [°]	Antenna Height [mt]
13,558	73,4	270	1,00

Radiated emissions measured from 9KHz to 30MHz. Peak detector (green trace) with IF=200Hz from 9KHz to 150KHz and IF=9KHz from 150KHz to 30MHz. Q-Peak/Average limit (red line). Horizontal polarization.

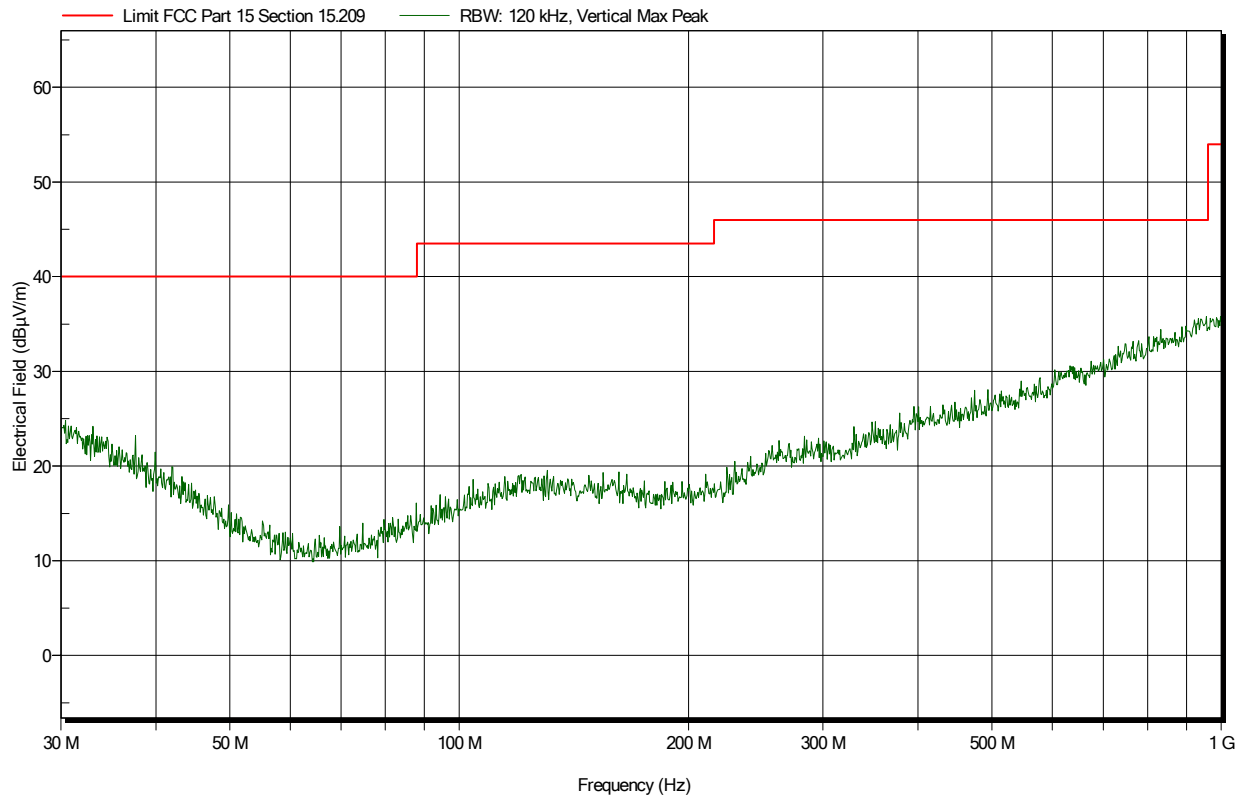


Peak amplitude of fundamental frequency

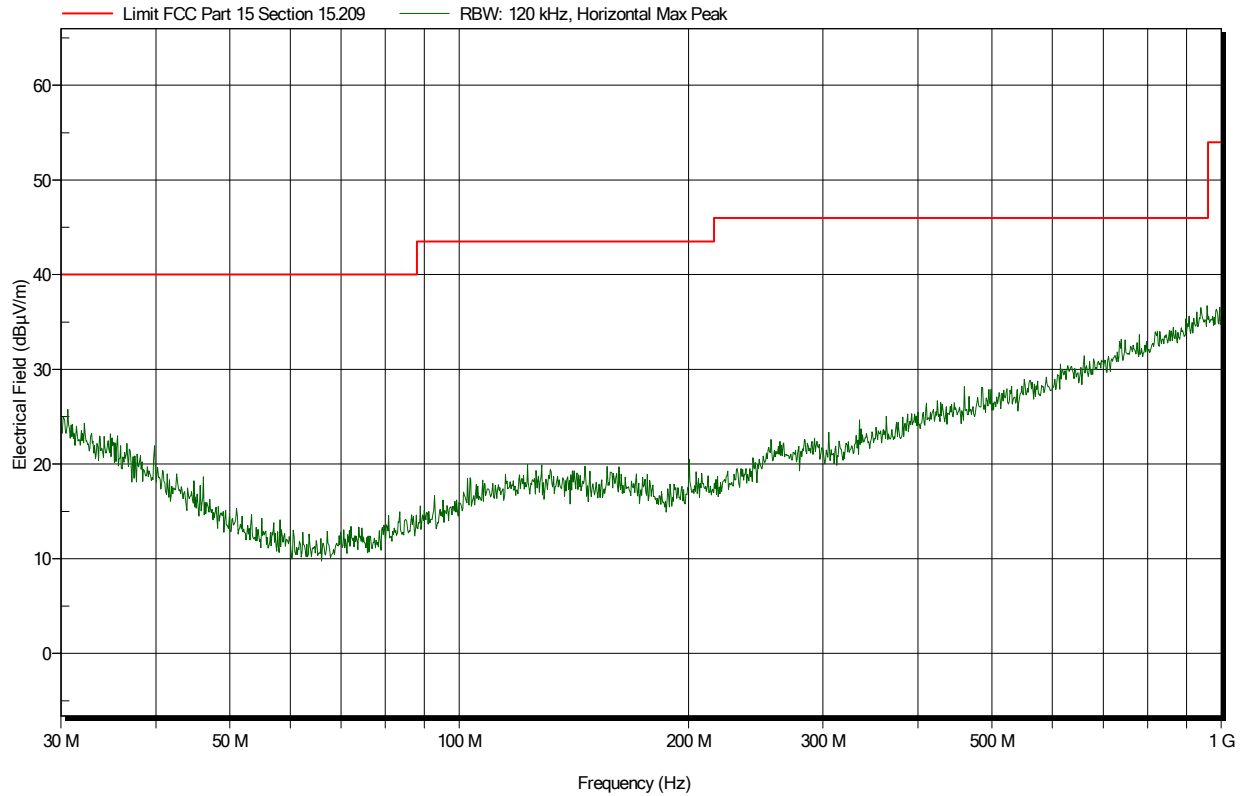
Frequency [MHz]	Peak [dBμV/m]	EUT Angle [°]	Antenna Height [mt]
13,558	68,5	180	1,00

Measures from 30MHz to 1GHz

Noise floor measured from 30MHz to 1GHz. Peak detector (green trace) with IF=120KHz. Q-Peak limit (red line). Vertical polarization.

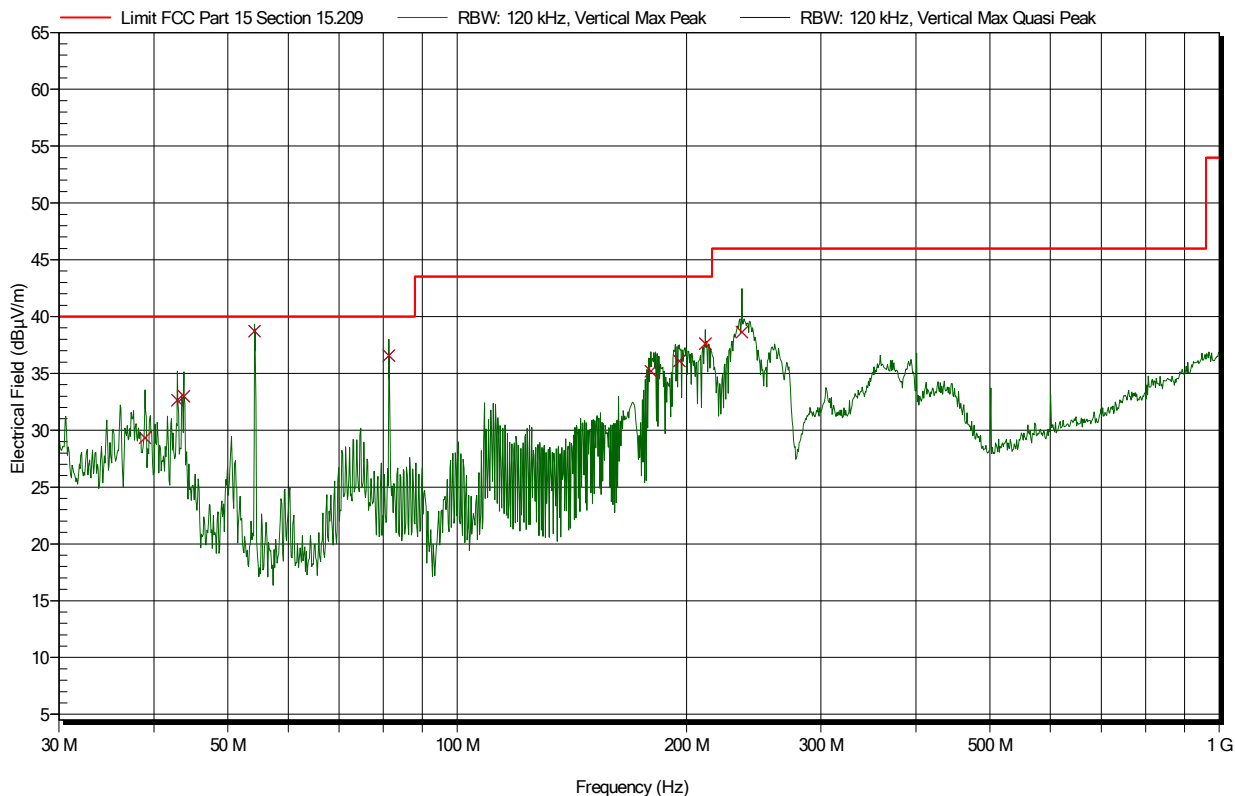


Noise floor measured from 30MHz to 1GHz. Peak detector (green trace) with IF=120KHz. Q-Peak limit (red line). Horizontal polarization.



Measure on EUT

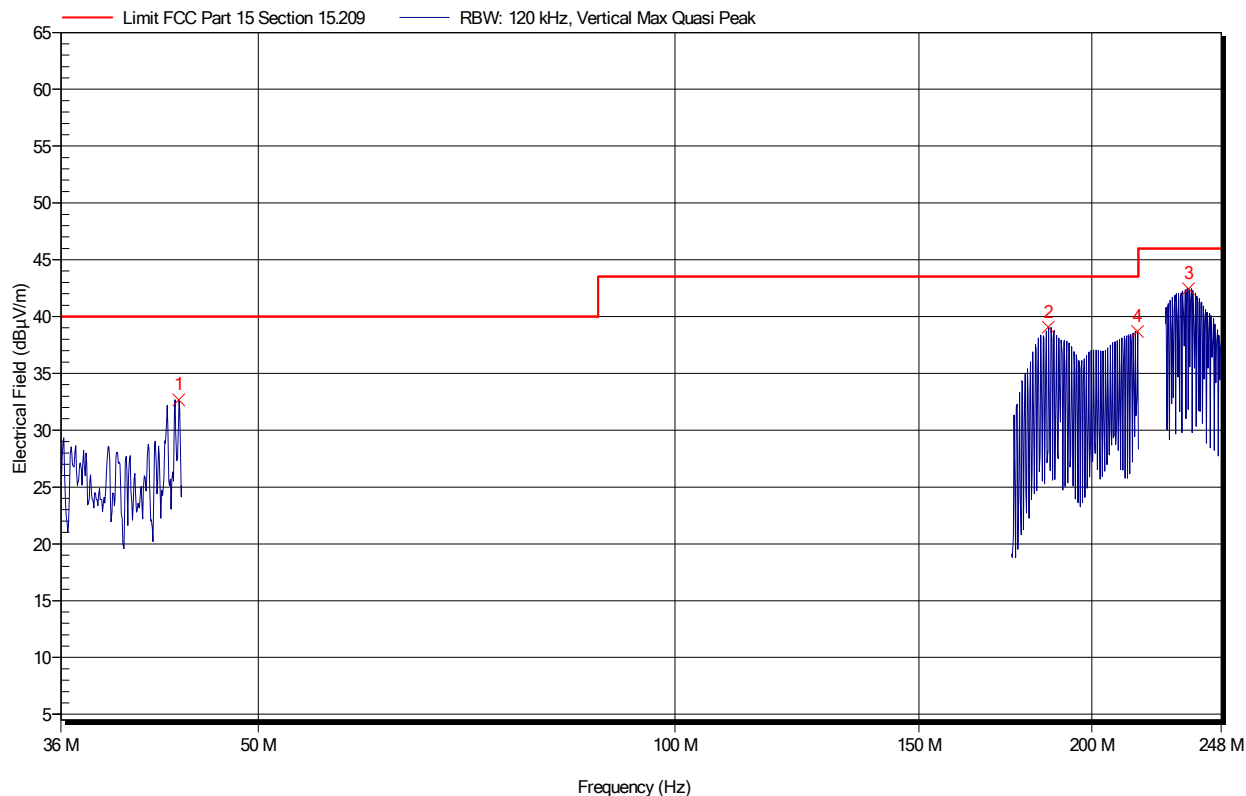
Radiated emissions measured from 30MHz to 1GHz. Peak detector (green trace) with IF=120KHz. Q-Peak limit (red line). Vertical polarization



Higher signals, maximized and re-measured with quasi-peak detector

Frequency [MHz]	Quasi-Peak [dBμV/m]	Quasi-Peak Limit [dBμV/m]	Difference from Limit [dBμV/m]	EUT Angle [°]	Antenna Height [mt]	Result
38,940	29,3	40,0	-10,7	90	1,00	Pass
42,930	32,7	40,0	-7,4	85	1,00	Pass
43,800	33,0	40,0	-7,0	90	1,00	Pass
54,240	38,7	40,0	-1,3	270	1,00	Pass
81,360	36,6	40,0	-3,4	190	1,20	Pass
179,580	35,2	43,5	-8,3	10	1,00	Pass
195,570	36,1	43,5	-7,4	10	1,00	Pass
211,620	37,6	43,5	-5,9	10	1,00	Pass
236,460	38,6	46,0	-7,4	0	1,00	Pass

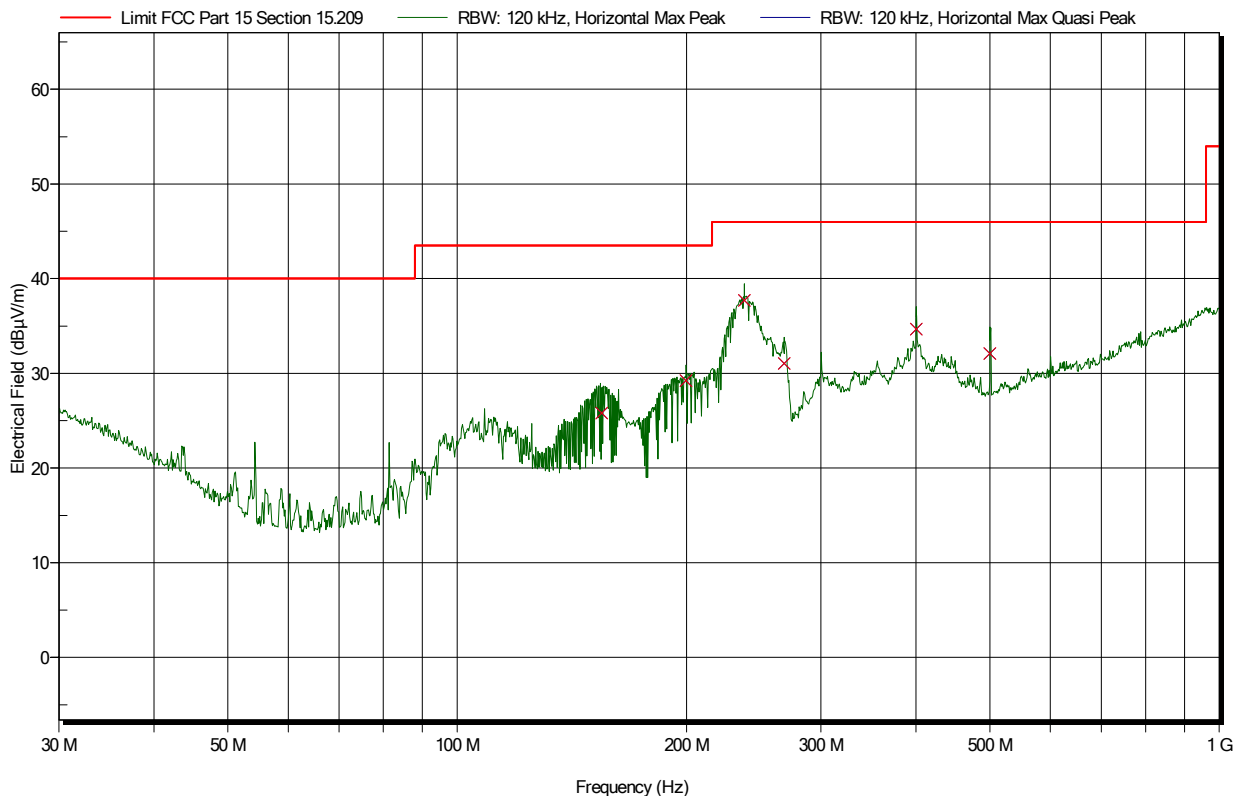
Radiated emissions maximized and remeasured with Quasi-Peak detector (blue trace) and IF=120KHz from 36MHz to 44MHz, from 175MHz to 216MHz and from 226MHz to 248MHz. Vertical polarization.



Signal list

Frequency [MHz]	Quasi-Peak [dBμV/m]	Quasi-Peak Limit [dBμV/m]	Difference from Limit [dBμV/m]	EUT Angle [°]	Antenna Height [mt]	Result
43,800	32,7	40,0	-7,3	90	1,00	Pass
186,010	39,1	43,5	-4,5	10	1,00	Pass
215,650	38,7	43,5	-4,8	10	1,00	Pass
234,880	42,4	46,0	-3,6	0	1,00	Pass

Radiated emissions measured from 30MHz to 1GHz. Peak detector (green trace) with IF=120KHz. Q-Peak limit (red line). Horizontal polarization.



Higher signals, maximized and re-measured with quasi-peak detector

Frequency [MHz]	Quasi-Peak [dBµV/m]	Quasi-Peak Limit [dBµV/m]	Difference from Limit [dBµV/m]	EUT Angle [°]	Antenna Height [mt]	Result
154,710	25,8	43,5	-17,7	58	2,30	Pass
199,620	29,2	43,5	-14,3	358	1,74	Pass
238,080	37,7	46,0	-8,3	215	1,23	Pass
268,560	31,1	46,0	-15,0	228	1,20	Pass
400,020	34,7	46,0	-11,3	145	1,00	Pass
500,040	32,1	46,0	-13,9	35	1,76	Pass

Allegato 1 / Annex 1: Incertezza / Uncertainty

A.1.1 Radiated Emissions: FCC

From 9kHz to 30MHz using Loop antenna
Field intensity : ± 4.2 dB

From 30MHz to 1000MHz using Bilog antenna
Field intensity : ± 4.7 dB

A.1.2 Conducted Emissions: FCC

Voltage Method : ± 2.6 dB

A.1.3 Radio test

Bandwidth : ± 0.1 KHz (Span=40KHz, RBW=1KHz, 1000pti)

RF Frequency : ± 90 Hz