DEKRA Certification, Inc.
405 Glenn Dr. Suite 12,
Sterling, VA 20164
United States of America

FCC LISTED, REGISTRATION NUMBER: 2764.01

ISED LISTED REGISTRATION NUMBER: 23595-1

Test report No:
3704ERM.002A3

Test report

USA FCC Part 15.249, 15.209
CANADA RSS-210, RSS-Gen
Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.

(*) Identification of item tested	Whole home leak detection and water monitoring device
(*) Trademark	Water Dragon
(*) Model and /or type reference tested	ADC-SHM-100-A
Other identification of the product	FCC ID: YL6-143SHM100 IC: 9111A-143SHM100
(*) Features	Z-Wave Mesh, Z-Wave Long Range
Manufacturer	Alarm.com, Inc 8281 Greensboro Dr, Suite 100 Tyson, VA 22102 USA
Test method requested, standard	USA FCC Part 15.249 10-1-20 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, 5725 - 5875 MHz, and 24.0 – 24.25 GHz. USA FCC Part 15.209 10-1-20 Edition: Radiated emission limits; general requirements. CANADA RSS-210 Issue 9 (August 2016). CANADA RSS-Gen Issue 5 (April 2018). ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Domingo Galvez EMC&RF Lab Manager Digitally signed by Domingo Galvez DN: cn=Domingo Galvez, o=DEKRA Certification Inc., ou=Regulatory Lab, email=dgalvez@dekra.com, c=US
Date of issue	03-09-2023
Report template No	FDT08_23 (*) "Data provided by the client"

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Competences and guarantees

DEKRA Certification Inc. is a testing laboratory accredited by A2LA (The American Association for Laboratory Accreditation), to perform the tests indicated in the Certificate 2764.01

DEKRA Certification Inc. is a testing laboratory competent to carry out the tests described in this report.

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

DEKRA Certification Inc. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Certification at the time of performance of the test.

DEKRA Certification Inc. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the item under test established in this document.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Certification Inc.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Certification Inc. and the Accreditation Bodies.

Uncertainty

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

Test case	Frequency (MHz)	U (k=2)	Units
Occupied Bandwidth	908-916	1.87	%
Radiated Spurious Emission	30-180	4.27	dB
	180-1000	3.14	dB
	1000-18000	3.30	dB
	18000-40000	3.49	dB

Data provided by the client

The Alarm.com Smart H2O Monitor is a non-intrusive water leakage detection device for residential and light commercial installation, giving property owners peace of mind. The Smart H2O Monitor supports whole home water leak detection and reporting to provide a comprehensive water solution. The primary use is for indoor-based water systems.

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples used for test have been selected by: The client.

Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
3704/01	Conducted sample	-	146	05/04/2022

Following Accessories items were used with Sample S/01 to perform testing:

Control Nº	Description	Model	Serial Nº	Date of reception
3704/04	AC/DC Adapter	-	-	05/04/2022
3704/08	USB to TTL Serial cable (3.3V) - 1.8m	TTL-232R03V3	-	05/04/2022

1. Sample S/01 was used for following test(s)

   All Conducted tests indicated in appendix A.

Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
3704/02	Radiated sample	-	146	05/04/2022

Following Accessories items were used with Sample S/02 to perform testing:

Control Nº	Description	Model	Serial Nº	Date of reception
3704/04	AC/DC Adapter	-	-	05/04/2022
3704/07	USB to TTL Serial cable (3.3V) - 1.8m	TTL-232R03V3	-	05/04/2022

1. Sample S/02 was used for following test(s)

   All Radiated tests indicated in appendix A.

Test sample description

Ports…… :	Port name and description		Cable			
			Specified length [m]	Attached during test	Shielded	Coupled to patient
	No Data Provided			☐	☐	☐
				☐	☐	☐
				☐	☐	☐
				☐	☐	☐
Supplementary information to the ports…… :	No Data Provided					
Rated power supply .....:	Voltage and Frequency		Reference poles			
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 5Vdc					
	☐	DC:					
Rated Power .....:	5VDC						
Clock frequencies.....:	No Data Provided						
Other parameters .....:	No Data Provided						
Software version .....:	No Data Provided						
Hardware version .....:	No Data Provided						
Dimensions in cm (W x H x D) ....:	No Data Provided						
Mounting position .....:	☐	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☐	Hand-held equipment					
	☒	Other: Water pipe					
Modules/parts.....:	Module/parts of test item		Type		Manufacturer		
	Z-Wave 700 Series / ZGM130S037HGN2R		Module		Silicon Labs		

Accessories (not part of the test item) .....:	Description	Type	Manufacturer
	No Data Provided		
Documents as provided by the applicant.....:	Description	File name	Issue date
	Declaration Equipment Data	FDT30_18 Declaration Equipment Data_AWACS	05/19/2022
Copy of marking plate:			
NO MARKING PLATE FOUND			

Identification of the client

Alarm.com, Inc
8281 Greensboro Dr, Suite 100
Tyson, VA 22102
USA

Testing period and place

Test Location	DEKRA Certification Inc.
Date (start)	05-04-2022
Date (finish)	05-16-2022

Document history

Report number	Date	Description
3704ERM.002	05-31-2022	First release
3704ERM.002A1	11-18-2022	Second release. Model name changed from ADC-SHM-100-A to Water Dragon. This modification of test report cancels and replaces the test report 3704ERM.002.
3704ERM.002A2	03-09-2023	Third release. Spectrum analyzer parameters used for test cases A.2 and A.3 added. Limits of Field strength of harmonics in A.3 test case added at page 21. This modification of test report cancels and replaces the test report 3704ERM.002A1.
3704ERM.002A3	03-09-2023	Fourth release. Trademark and Model and /or type reference tested were updated per customer request. This modification of test report cancels and replaces the test report 3704ERM.002A2.

Environmental conditions

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Lakshmi Gollamudi, Koji Nishimoto, Nasir Khan and Cheikhna Ouattara.

Testing verdicts

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

Summary

FCC PART 15.249 PARAGRAPH / RSS-249 (Z-wave)					
Report Section	**FCC Spec Clause**	**RSS Spec Clause**	**Test Description**	**Verdict**	**Remark**
A.1	§ 2.1049	RSS-Gen 6.7	99% Occupied Bandwidth	P	N/A
A.2	§ 15.249 (a)	RSS-210 B.10 (a)	Field Strength of fundamental	P	N/A
A.3	§ 15.249 (d)	RSS-210 B.10 (b)	Emission limitations radiated (Transmitter)	P	N/A
Supplementary information and remarks: None.					

List of equipment used during the test

Conducted Measurements

CONTROL NUMBER	DESCRIPTION	MANUFACTURER	MODEL	LAST CALIBRATION	NEXT CALIBRATION
1039	FSV40 Signal analyzer 40 GHz	Rohde & Schwarz	FSV40	2020/09	2022/09
1107	Ethernet SNMP Thermometer- SAC	HW Group	HWg-STE Plain	2020/08	2022/08

Radiated Measurements

CONTROL NUMBER	DESCRIPTION	MANUFACTURER	MODEL	LAST CALIBRATION	NEXT CALIBRATION
0981	RF pre-amplifier	Bonn Elektronik	BLMA0118-2A	2020/11	2022/11
1012	EMI TEST RECEIVER	Rohde & Schwarz	ESR 26	2022/04	2024/04
1014	Spectrum analyzer	Rohde & Schwarz	FSV40	2021/05	2023/05
1057	Double-ridge Waveguide Horn antenna 1-18 GHz	ETS LINDGREN	3115	2020/06	2023/06
1065	Biconical Log antenna	ETS LINDGREN	3142E	2020/08	2023/08
1111	ETHERNET SNMP THERMOMETER	HW GROUP	HWg-STE Plain	2020/08	2022/08
1179	Semi anechoic Absorber Lined Chamber	Frankonia	SAC 3 plus “L”	N/A	N/A
1314	WIRELESS MEASUREMENT SOFTWARE R&S EMC32	Rohde & Schwarz	N/A	N/A	N/A

Appendix A: Test results (Z-wave)

Appendix A Content

PRODUCT INFORMATION

The following information is provided by the client

Information	**Description**
Modulation	GFSK/FSK
Adaptive	Non-Adaptive Equipment
Operation mode	
- Operating Frequency Range	908.4MHz / 916MHz
- RF Output Power	-5 dBm
Antenna type	PCB trace
Antenna gain	2.6 dBi (Peak)
Nominal Voltage	
- Supply Voltage	5 Vdc
- Type of power source	AC/DC Adapter
Equipment type	Z-wave Mesh
Geo-location capability	No

DESCRIPTION OF TEST CONDITIONS

TEST CONDITIONS	DESCRIPTION
TC#01	Power supply (V): $V_{nominal}$ = 5 Vdc Modulation: GFSK/FSK Test Frequencies for Conducted/ Radiated tests: Channel 0: 916.0 MHz - Baud Rate (100kbps) Channel 1: 908.4 MHz - Baud Rate (40kbps) Channel 2: 908.4 MHz - Baud Rate (9.6kbps)

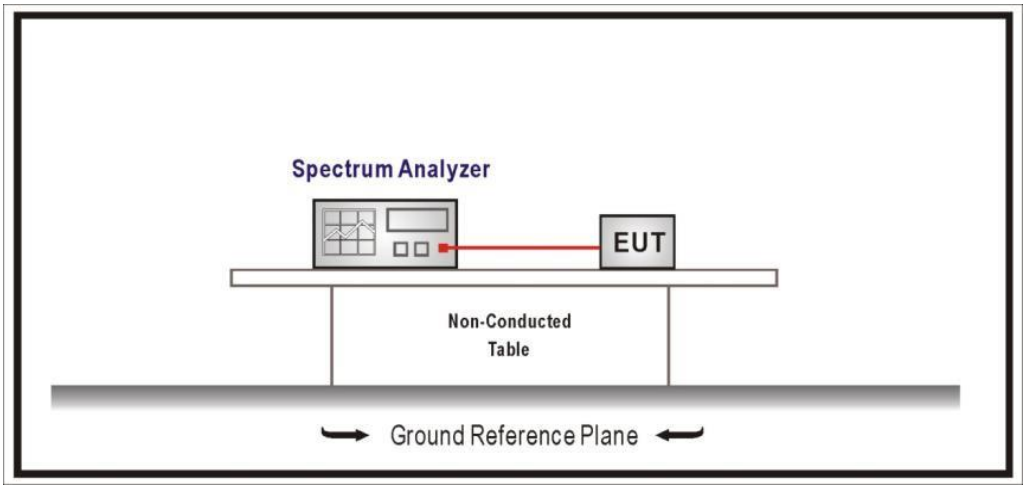
TEST A.1: 99% OCCUPIED BANDWIDTH

LIMITS:	Product standard:	§ 2.1049 and RSS-Gen
	Test standard:	§ 2.1049 and RSS-Gen 6.7

LIMITS

The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs

TEST SETUP	

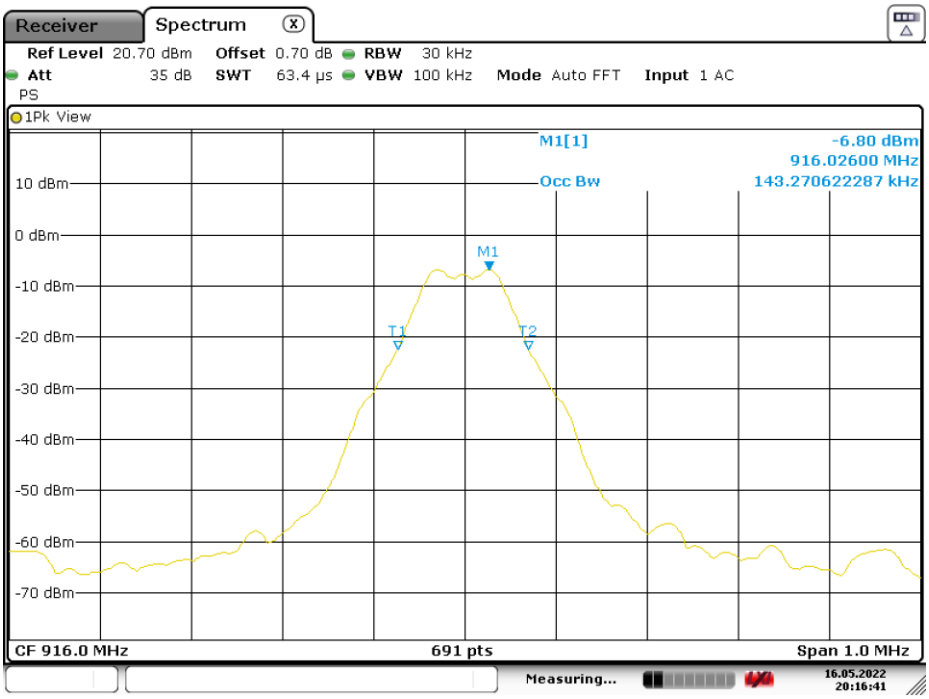


TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

	Channel 0 916 MHz	Channel 1 908.4 MHz	Channel 2 908.4 MHz
99% bandwidth (kHz)	143.27	124.46	125.90

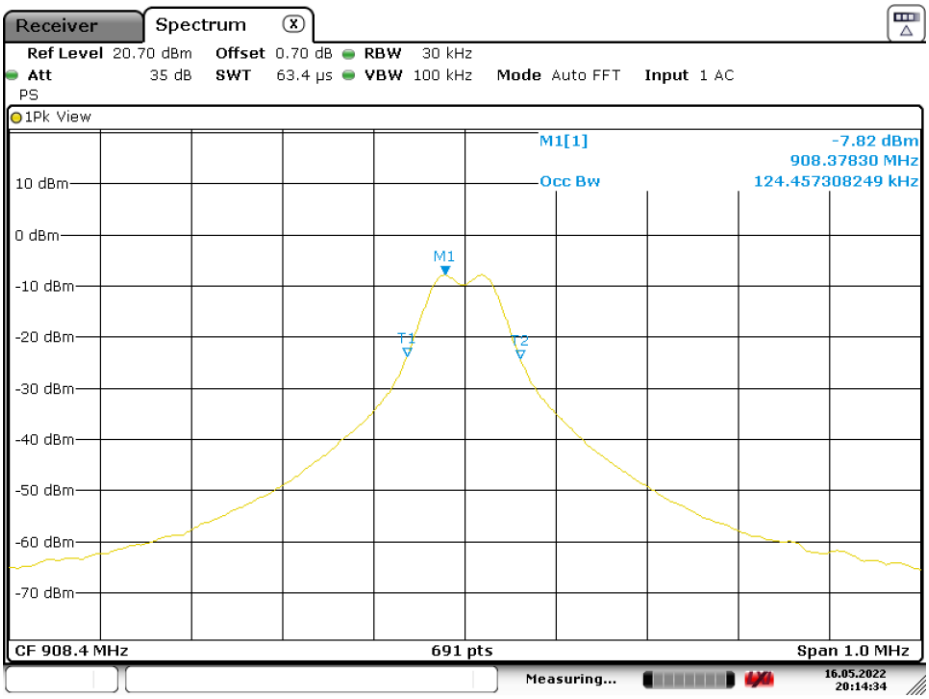
TEST RESULTS (Cont.):	

Channel 0



Date: 16.MAY.2022 20:16:41

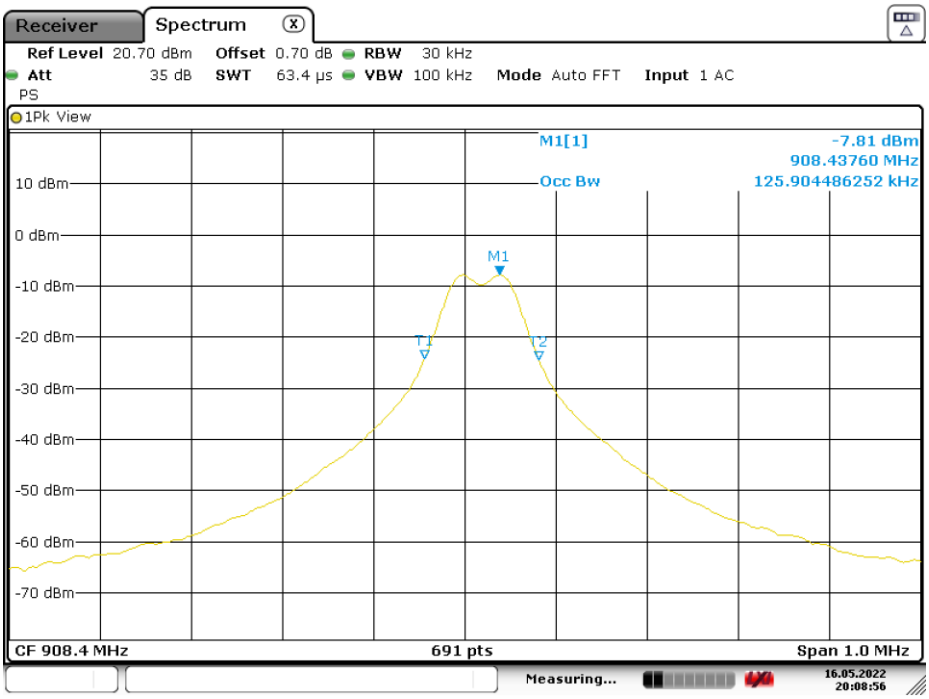
Channel 1



Date: 16.MAY.2022 20:14:34

TEST RESULTS (Cont.):	

Channel 2



Date: 16.MAY.2022 20:08:56

TEST A.2: FUNDAMENTAL FIELD STRENGTH

LIMITS:	Product standard:	Part 15 Subpart C §15.249 and RSS-210
	Test standard:	Part 15 Subpart C §15.249(a) and RSS-210 B.10(a)

LIMITS

The field strength of emissions in this band shall not exceed 2500 millivolts/meter. The field strength of emissions from intentional radiators shall comply with the following

Frequency Range (MHz)	Field strength of fundamental (mV/m)	Field strength (dBµV/m)	Measurement distance (m)
902 - 928	50	93.98	3
2400 – 2483.5	50	93.98	3
5725 - 5875	50	93.98	3
24000-24250	250	107.96	3

For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RSS-210. The field strength of fundamental and harmonic emissions, measured at 3 m, shall not exceed 50 mV/m and 0.5 mV/m respectively. Attenuation below the general field strength limits specified in RSS-Gen is not required

TEST SETUP	

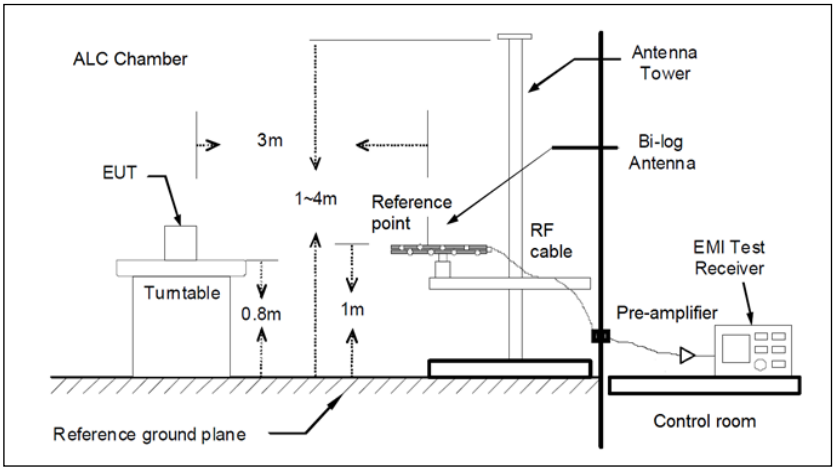
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30-1000 MHz (Bilog antenna).

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

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

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

Radiated measurements setup f < 1 GHz

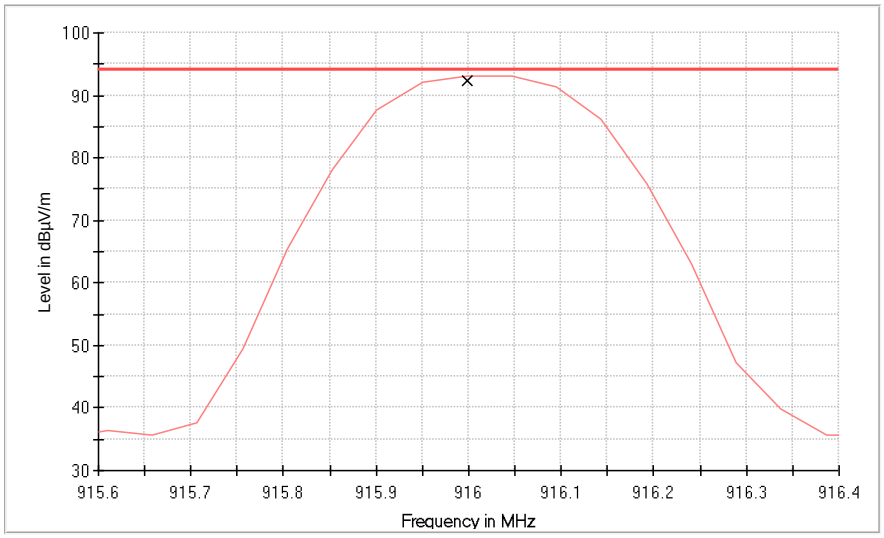


TESTED SAMPLES:	S/02
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

	Channel 0 916 MHz	Channel 1 908.4 MHz	Channel 2 908.4 MHz
Field strength (dBµV/m)	92.5	92.5	90.0

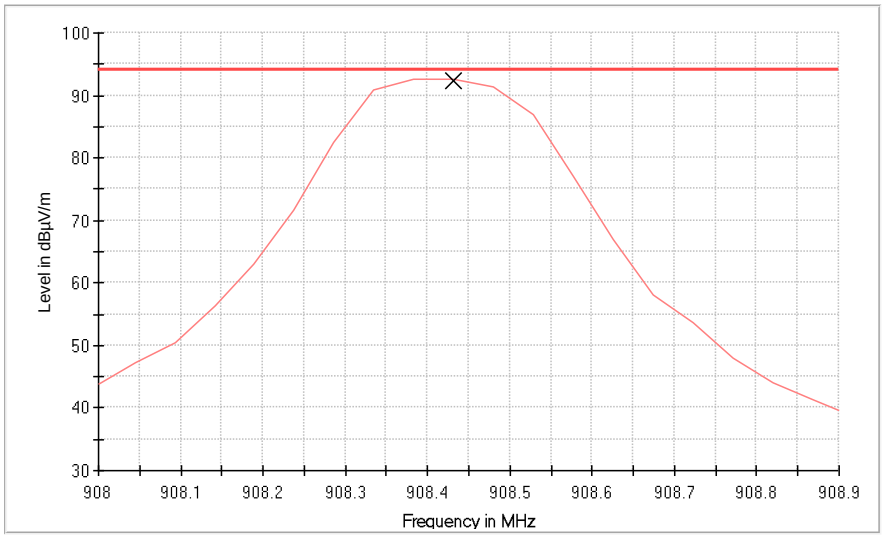
TEST RESULTS (Cont.):	

Channel 0



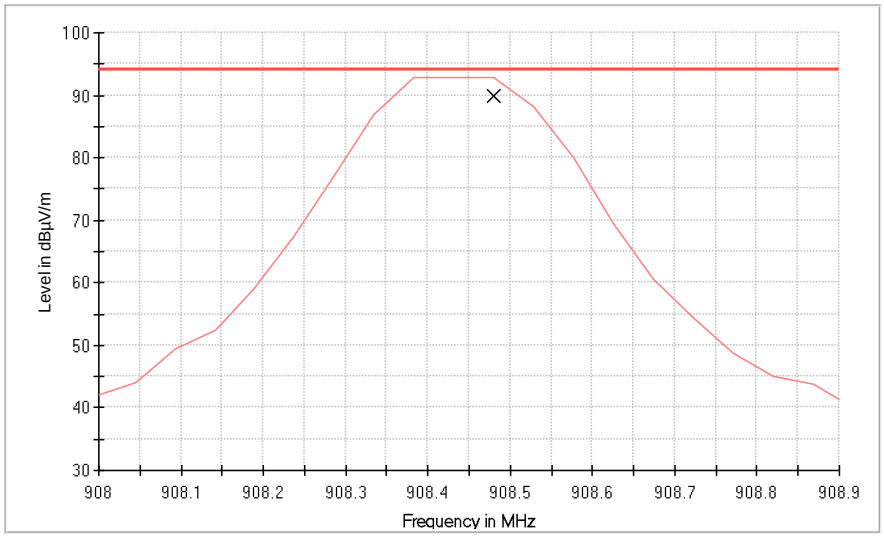
TEST RESULTS (Cont.):	

Channel 1



d

Channel 2



Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time
30 MHz - 1 GHz	48.5 kHz	PK+	100 kHz	1 s

TEST A.3: EMISSION LIMITATIONS RADIATED (TRANSMITTER)

LIMITS:	Product standard:	Part 15 Subpart C §15.249 and RSS-210
	Test standard:	Part 15 Subpart C §15.249(b), RSS-210 and RSS-Gen 8.9 and 8.10

LIMITS

The field strength of harmonics from intentional radiators shall comply with section 15.249 mentioned as the following:

Frequency Range (MHz)	Field strength of fundamental (mV/m)	Field strength (dBµV/m)	Field strength of harmonics (µV/m)	Measurement distance (m)
902 - 928	50	93.98	500	3
2400 – 2483.5	50	93.98	500	3
5725 - 5875	50	93.98	500	3
24000-24250	250	107.96	2500	3

Radiated emissions outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

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

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

TEST SETUP	

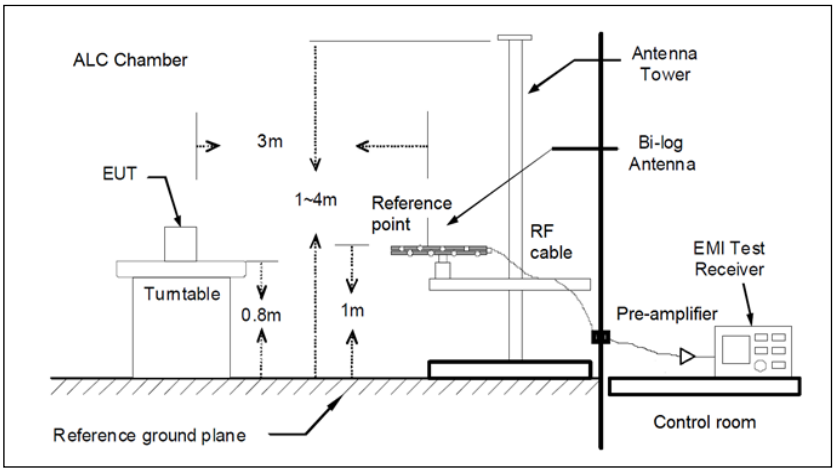
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30-1000 MHz (Bilog antenna) and 1 GHz-18 GHz (Double ridge horn antenna).

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

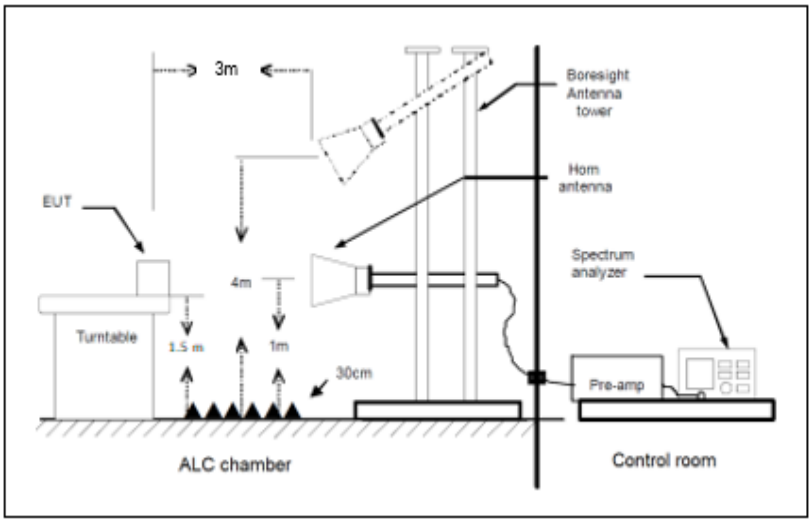
Measurements were made in both horizontal and vertical planes of polarization.

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

Radiated measurements Setup f < 1 GHz

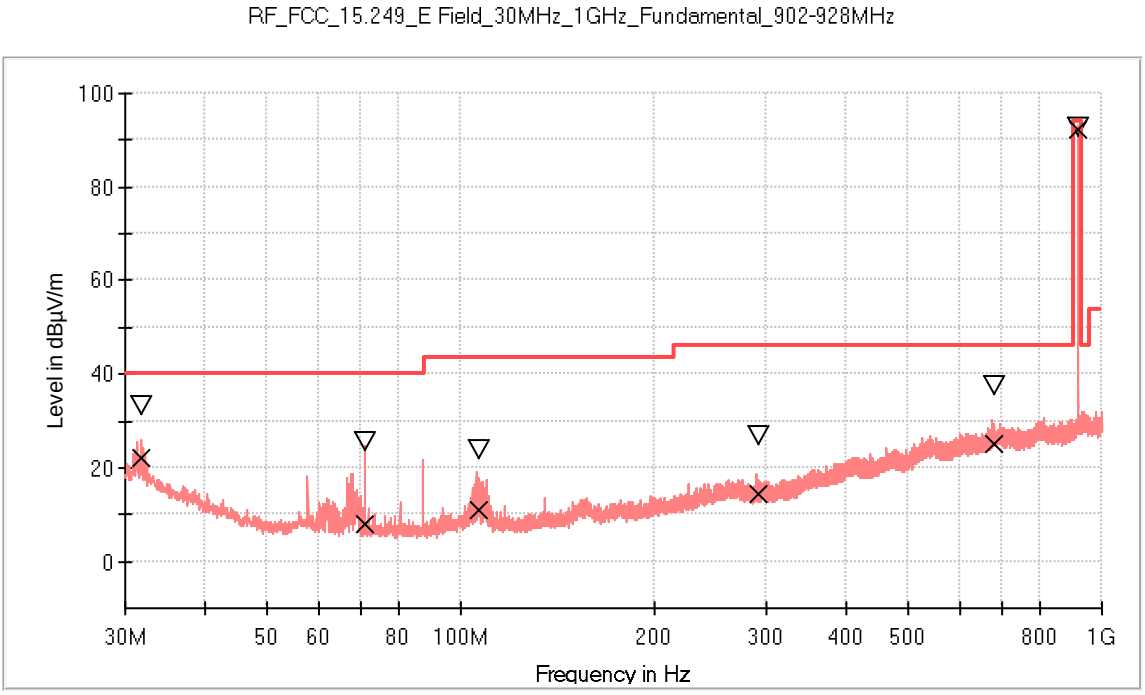


Radiated measurements setup f > 1 GHz



TESTED SAMPLES:	S/02
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

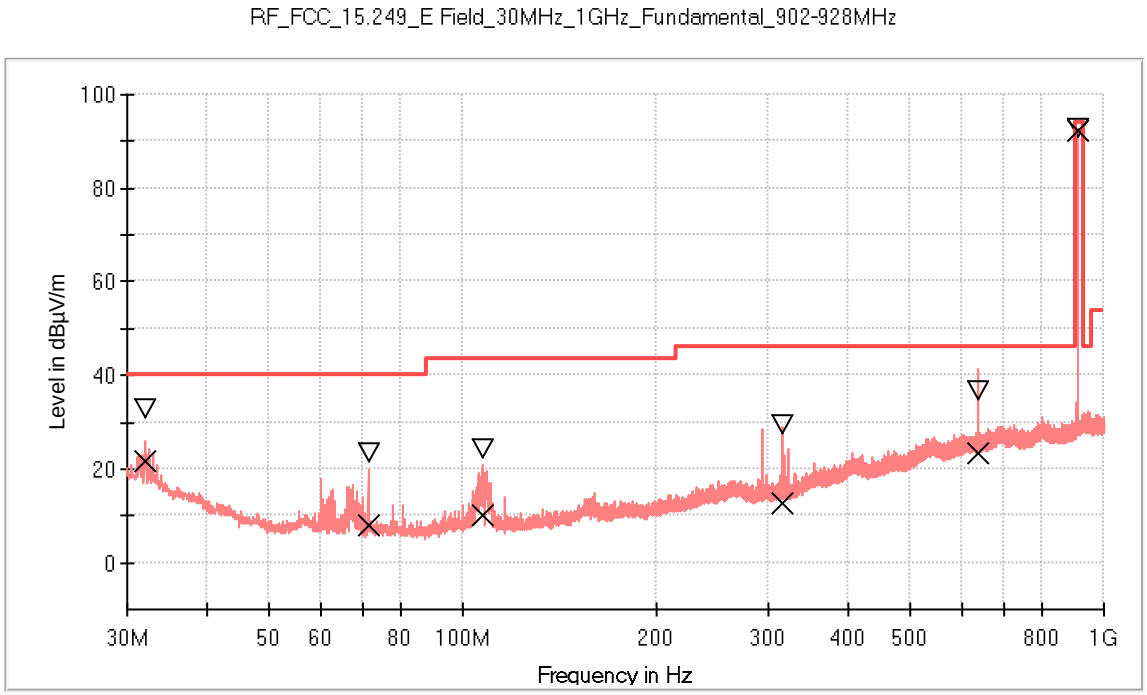
Channel 0



Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBµV/m)	Comment
31.794500	33.1	22.0	V	18.0	40.0	
71.128000	25.6	8.0	V	32.0	40.0	
106.872500	23.9	10.9	V	32.6	43.5	
292.094000	26.8	14.4	H	31.6	46.0	
680.967000	37.7	24.9	H	21.1	46.0	
915.998000	92.7	92.5	H	1.5	94.0	Fundamental

TEST RESULTS (Cont.):	30-1000 MHz

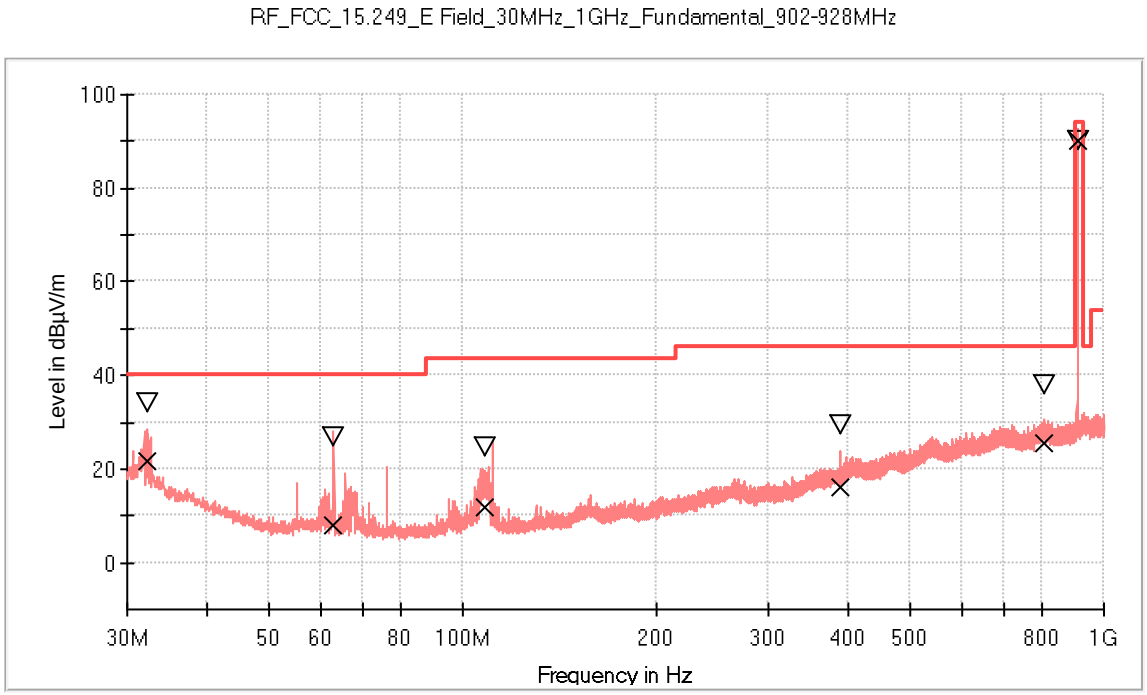
Channel 1



Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBµV/m)	Comment
32.037000	32.9	21.8	V	18.2	40.0	
71.225000	23.5	7.8	V	32.2	40.0	
107.697000	24.3	10.3	V	33.2	43.5	
315.374000	29.2	12.8	H	33.2	46.0	
637.026000	36.6	23.4	H	22.6	46.0	
908.432000	92.6	92.5	H	1.5	94.0	Fundamental

TEST RESULTS (Cont.):	30-1000 MHz

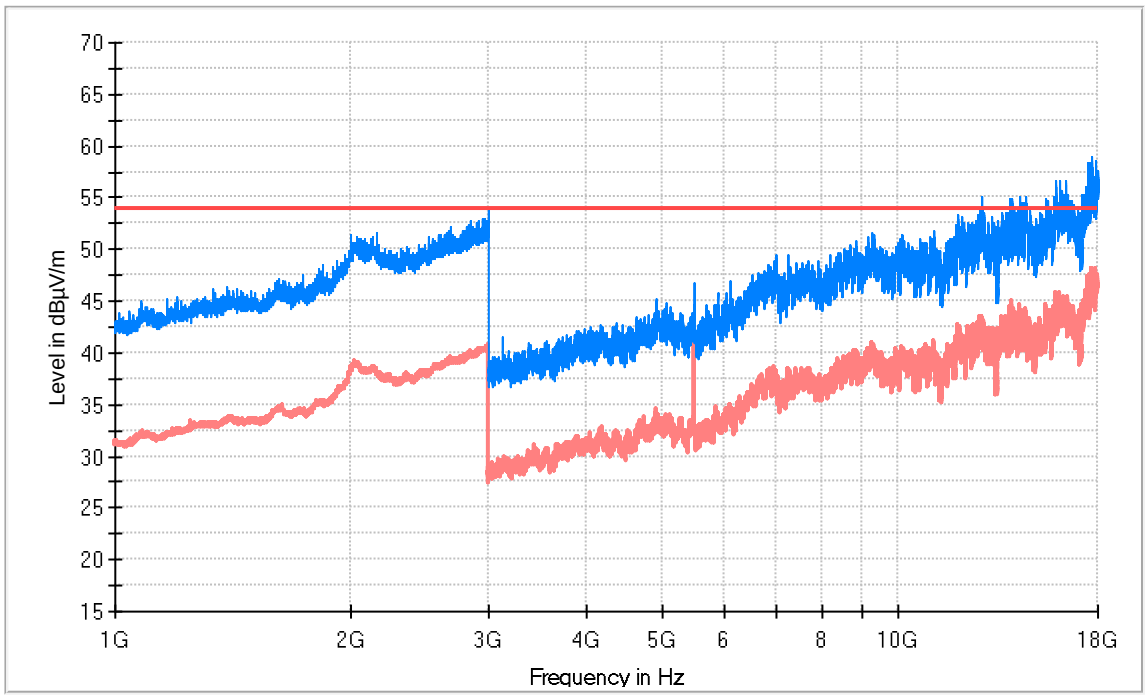
Channel 2



Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBµV/m)	Comment
32.328000	34.3	21.6	V	18.4	40.0	
62.980000	26.9	8.1	V	31.9	40.0	
108.133500	24.8	11.7	V	31.8	43.5	
389.191000	29.2	16.3	V	29.7	46.0	
809.298000	38.0	25.4	H	20.6	46.0	
908.480500	90.3	90.0	H	4.0	94.0	Fundamental

TEST RESULTS (Cont.):	1-18 GHz

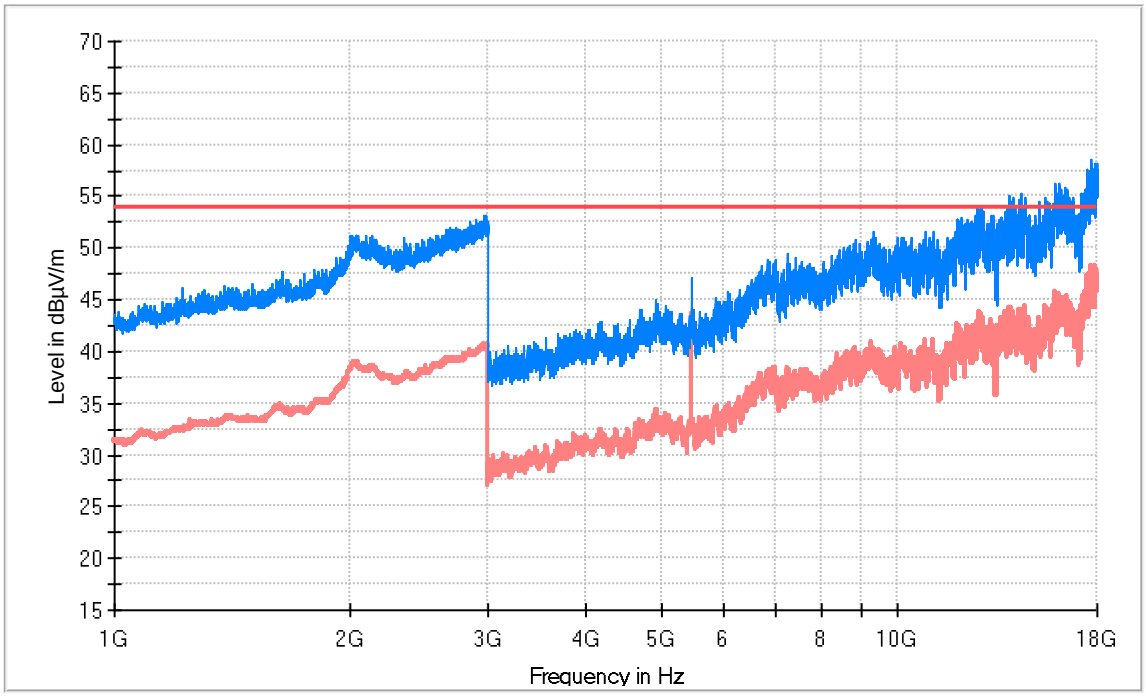
Channel 0



Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
5496.000000	46.8	42.9	H	11.1	54.0
17653.000000	57.4	48.2	H	5.8	54.0

TEST RESULTS (Cont.):	1-18 GHz

Channel 1

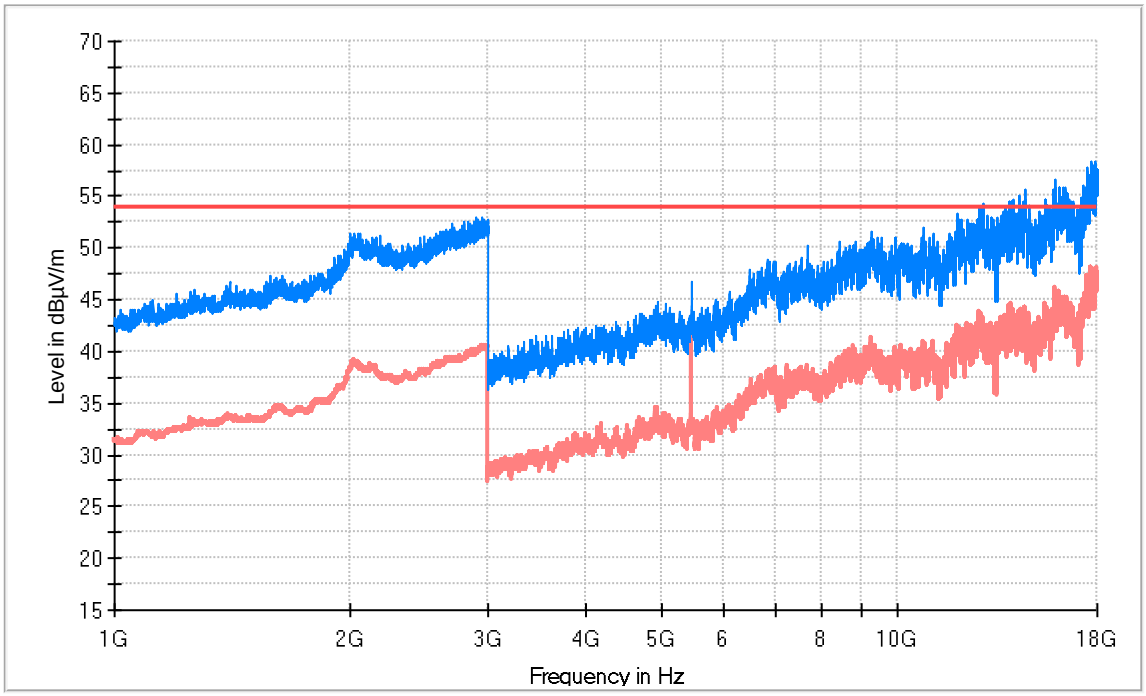


AVG_MAXH
PK+_MAXH
TX limits to Spurious Emission FCC15.249 (Above 1GHz) 902-928MHz_Average Limit

Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
5450.000000	47.1	43.7	H	10.2	54.0
17666.000000	56.9	48.4	H	5.6	54.0

TEST RESULTS (Cont.):	1-18 GHz

Channel 2



Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
5450.500000	46.6	43.3	H	10.7	54.0
17667.500000	57.4	48.2	H	5.8	54.0

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time
30 MHz - 1 GHz	48.5 kHz	PK+	100 kHz	1 s
1 GHz - 3 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s
3 GHz - 18 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s