

ISED CABid: ES1909
Lab. Company Number: 4621A

Test Report No:
74509RRF.001A1

Partial Test Report

USA FCC Part 22

CANADA RSS-132

(*) Identification of item tested	Aveir device remote monitoring
(*) Trademark	AVEIR™ Patient Transmitter
(*) Model and/or type reference	LSRM01
Other identification of the product	FCC ID: 2A76T00NRF9160 IC: 7067A-00NRF9160
(*) Features	ECG monitoring, LTE Cat-M1 and NB-IoT HW version: DVT1.1 SW version: RSSI_V2.0.0_LTE + RSSI_V2.0.0_NBIOT
Applicant	Abbott Medical 15900 Valley View Court Sylmar, CA 91342, USA
Test method requested, standard	USA FCC Part 22 (10-1-21 Edition). CANADA RSS-132 Issue 4, Jan. 2023. ANSI C63.26-2015. KDB 971168 D01 Power Meas License Digital Systems v03r01, April. 2018.
Approved by (name / position & signature)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager
Date of issue	2024-01-22
Report template No	FDT08_24 (*) "Data provided by the client"

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Competences and guarantees

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DEKRA Testing and Certification is an FCC-recognized accredited testing laboratory with appropriate scope of accreditation that covers the performed tests in this report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory, CABid: ES1909, Company Number: 4621A, with the appropriate scope of accreditation that covers the performed tests in this report.

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1. This report is only referred to the item that has undergone the test.
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4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of an Aveir device remote monitoring. ECG monitoring that communicates over LTE and NB-IoT.

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

Usage of samples

Samples undergoing 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
74509/001	Aveir device remote monitoring	LSRM01	772AT300013	20-09-2023

Sample S/01 has undergone the following test(s): The radiated tests indicated in Appendix A. Software version: RSSI_V2.0.0_LTE

- Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
74509/002	Aveir device remote monitoring	LSRM01	772AT300005	20-09-2023

Sample S/02 has undergone the following test(s): The radiated tests indicated in Appendix B. Software version: RSSI_V2.0.0_NBIOT

Test sample description

Ports.....:	Port name and description		Cable			
			Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾
	Jack 2.5	1.27	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	Jack 2.5	1.27	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	Jack 3.5	1.27	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Supplementary information to the ports.....:	-					
Rated power supply	Voltage and Frequency					
	<input checked="" type="checkbox"/> DC: 9V					
Rated Power.....:	1200mAh					
Clock frequencies.....:	DSP 22.1184MHz. nRF5340 32.786kHz, RTC: nRF5340 32MHz. CPLD: 48MHz					
Other parameters	-					
Software version.....:	RSSI_V2.0.0_LTE + RSSI_V2.0.0_NBIOT					
Hardware version	DVT1.1					
Dimensions in cm (W x H x D) ...:	199mm x 187mm x 58mm					
Mounting position	<input type="checkbox"/>	Table top equipment				
	<input type="checkbox"/>	Wall/Ceiling mounted equipment				
	<input type="checkbox"/>	Floor standing equipment				
	<input checked="" type="checkbox"/>	Hand-held equipment				
	<input type="checkbox"/>	Other:				
Modules/parts.....:	Module/parts of test item		Type	Manufacturer		
	PLM EMC		DUT	Celestica		
	PLM Immunity		DUT	Celestica		
	PLM Safety (Mechanical and electronic)		DUT	Celestica		
	PLM RSSI LTE & NB-IoT		DUT	Celestica		
Accessories (not part of the test item)	Description		Type	Manufacturer		
	Patient Cables		Cables	Exceltek		
	Daughterboard		PCB	Abbott		
	Patientboard		PCB	Abbott		
	Pacemakers		LP	Abbott		
	Rottom Board		PCB	Celestica		
	FTDI, Tag Connect and Power Jack		Cables	N/A		
Documents as provided by the applicant	Description		File name	Issue date		
	Aveir PT Safety DVTP RevA		91014744_R ev	27/09/23		
	Aveir PT RF DVTP RevA		91016193_R ev	27/09/23		
	Aveir PT EMC/EMI DVTP RevA		91016747_A	27/09/23		

⁽³⁾ Only for Medical Equipment

Identification of the client

Abbott Medical
15900 Valley View Court
Sylmar, CA 91342, USA

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2023-10-19
Date (finish)	2023-10-20

Document history

Report number	Date	Description
74509RRF.001	2023-12-14	First release.
74509RRF.001A1	2024-01-22	First modification. The test report is modified to complete the information provided by the client. Software version declared is modified. This modification test report cancels and replaces the test report 74509RRF.001

Environmental conditions

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

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

In the semi-anechoic chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Álvaro Gutiérrez, Valentín Andarias.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
6791	SEMIANECHOIC ABSORBER LINED	FACT 3 200 STP	ETS LINDGREN	N/A
6792	SHIELDED ROOM	S101	ETS LINDGREN	N/A
7817	EMI TEST RECEIVER 2Hz-44GHz	ESW44	ROHDE AND SCHWARZ	2023-12
6143	Biconical/Log Antenna 30 MHz - 6 GHz	3142E	ETS LINDGREN	2023-10
7763	HORN ANTENNA 1-18 GHz	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	2026-01
8912	Wideband Radio Communication Tester	CMW500	ROHDE AND SCHWARZ	2023-09
4848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	N/A

Testing verdicts

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

Summary

Appendix A: LTE Cat-M1 Band 5.

FCC PART 22 / RSS-132 PARAGRAPH		
Requirement – Test case	Verdict	Remark
FCC 22.913 / RSS-132 5.4: RF Output Power	N/M	(1)
FCC 2.1047 / RSS-132 5.2: Modulation Characteristics	N/M	(1)
FCC 22.355 / RSS-132 5.3: Frequency Stability	N/M	(1)
FCC 2.1049: Occupied Bandwidth	N/M	(1)
FCC 22.917 / RSS-132 5.5: Spurious Emissions at Antenna Terminals	N/M	(1)
FCC 22.917 / RSS-132 5.5: Spurious Emissions at Antenna Terminals at Block Edges	N/M	(1)
FCC 22.917 / RSS-132 5.5: Radiated Emissions	P	
<u>Supplementary information and remarks:</u>		
(1) Test not requested.		

Appendix B: LTE Cat NB1 Band 5.

FCC PART 22 / RSS-132 PARAGRAPH		
Requirement – Test case	Verdict	Remark
FCC 22.913 / RSS-132 5.4: RF Output Power	N/M	(1)
FCC 2.1047 / RSS-132 5.2: Modulation Characteristics	N/M	(1)
FCC 22.355 / RSS-132 5.3: Frequency Stability	N/M	(1)
FCC 2.1049: Occupied Bandwidth	N/M	(1)
FCC 22.917 / RSS-132 5.5: Spurious Emissions at Antenna Terminals	N/M	(1)
FCC 22.917 / RSS-132 5.5: Spurious Emissions at Antenna Terminals at Block Edges	N/M	(1)
FCC 22.917 / RSS-132 5.5: Radiated Emissions	P	
<u>Supplementary information and remarks:</u>		
(1) Test not requested.		

Appendix A: Test results for FCC 22 / RSS-132: LTE Cat-M1 Band 5

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TEST CONDITIONS

(*): Declared by the Applicant.

POWER SUPPLY (*):

Vnormal: 9 Vdc
Type of Power Supply: Internal batteries.

ANTENNA (*):

Bands	Gain (dBi)	Type
LTE Cat-M1 5	+4.3	Linear Polarization

TEST FREQUENCIES:

LTE Cat-M1 Band 5. QPSK and 16QAM:

	Channel (Frequency MHz)			
	BW=1.4 MHz	BW=3 MHz	BW=5 MHz	BW=10 MHz
Low	20407 (824.70)	20415 (825.50)	20425 (826.50)	20450 (829.00)
Middle	20525 (836.50)	20525 (836.50)	20525 (836.50)	20525 (836.50)
High	20643 (848.30)	20635 (847.50)	20625 (846.50)	20600 (844.00)

Radiated Emissions

Limits

* FCC § 2.1051 and § 22.917:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

Compliance with these rules is based on the use of measurement instrumentation employing a reference bandwidth as follows:

In the spectrum below 1 GHz, instrumentation should employ a reference bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

- * RSS-132. 5.5: Mobile and base station equipment shall comply with the limits in (i) and (ii) below.
- i. In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} P$ (watts).
 - ii. After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} P$ (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

Method

The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the high frequency generated within the equipment.

The EUT was placed on a 80 centimetres high non-conductive stand at a 3 meter distance from the measuring antenna.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the height and polarization of the measuring antenna. The maximum meter reading was recorded.

Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB, P in watts.

At P_o transmitting power, the specified minimum attenuation becomes $43+10\log (P_o)$, and the level in dBm relative P_o becomes:

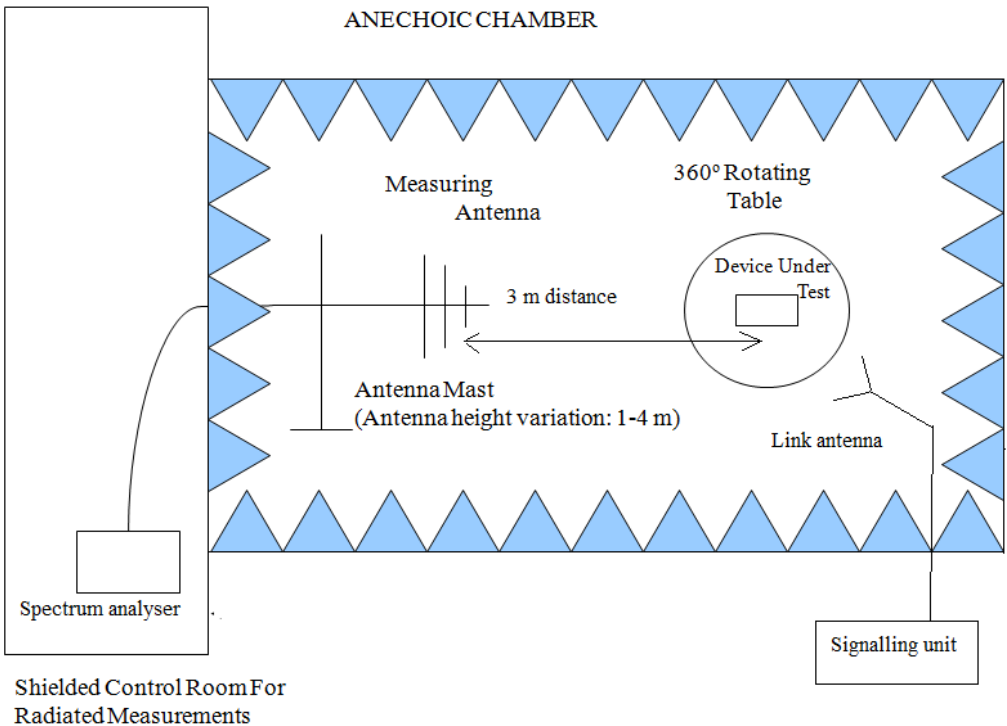
$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = - 13 \text{ dBm}$$

The maximum field strength (dBμV/m) of each detected emission at less than 20 dB respect to the limit is converted to an equivalent EIRP level (dBm) according to ANSI C63.26 with the formula:

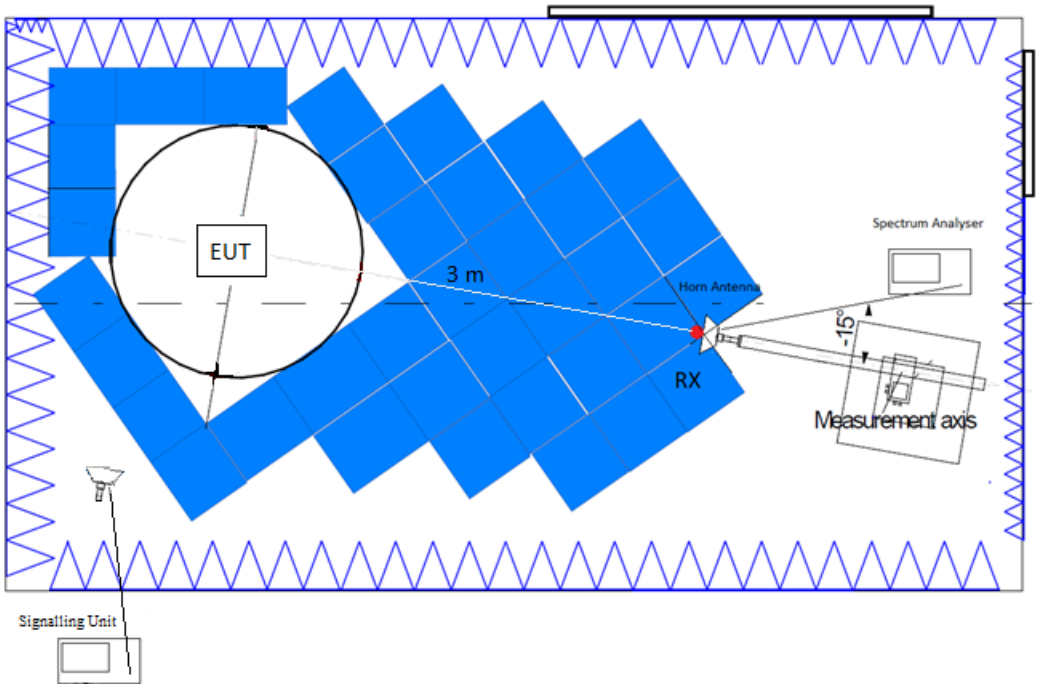
$EIRP \text{ (dBm)} = E \text{ (dBμV/m)} + 20 \log(D) - 104.8$; where D is the measurement distance (in the far field region) in m. D = 3 m

Test Setup

Radiated measurements below 1 GHz:



Radiated measurements above 1 GHz:



Results

LTE Cat-M1 Band 5:

A preliminary scan determined the BW=5 MHz, QPSK, RB Size=1, RB Offset=2, Narrowband=1 as the worst case. The following results are for this worst-case configuration.

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8.5 GHz:

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector
2.47703125	-32.36	V	Peak

- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8.5 GHz:

No spurious frequencies at less than 20 dB below the limit.

- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 8.5 GHz:

No spurious frequencies at less than 20 dB below the limit.

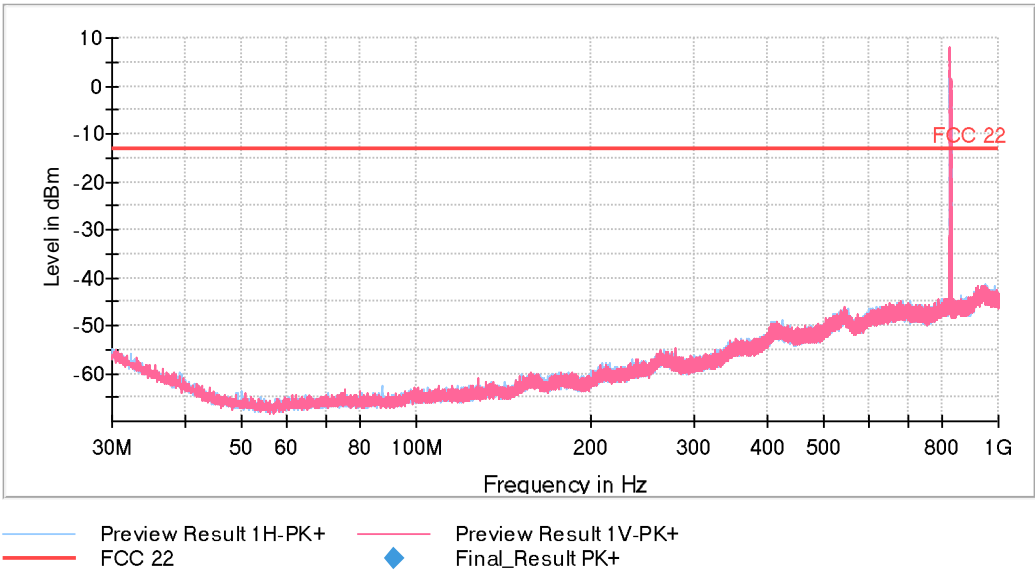
Measurement uncertainty (dB): <± 5.03 for f ≥ 30 MHz up to 1 GHz
<± 4.32 for f ≥ 1 GHz up to 8.5 GHz

Verdict: PASS

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	1 MHz	1 s	0 dB
1 GHz - 8.5 GHz	234.375 kHz	PK+	1 MHz	1 s	0 dB

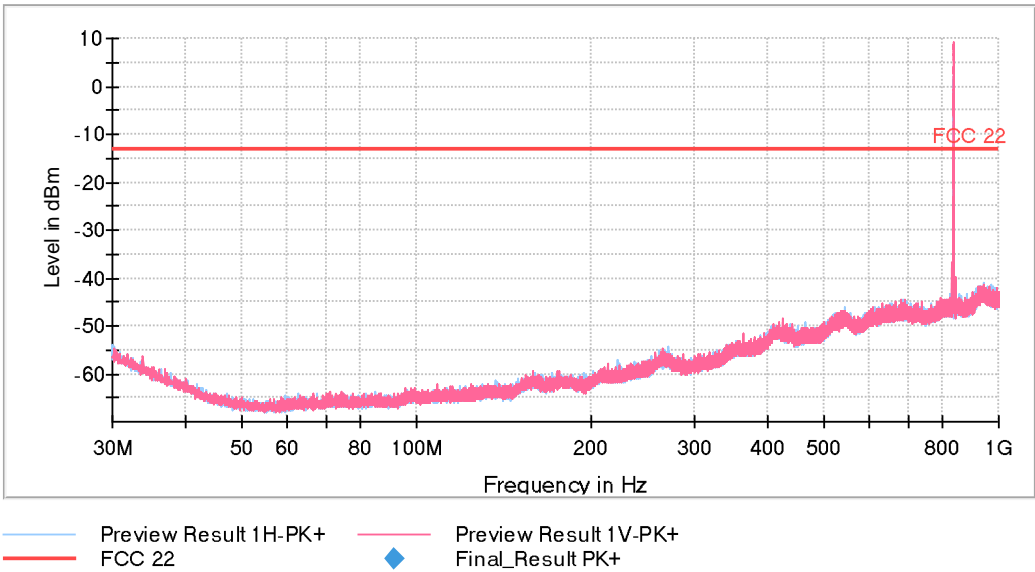
FREQUENCY RANGE 30 MHz - 1 GHz:

- LOW CHANNEL:



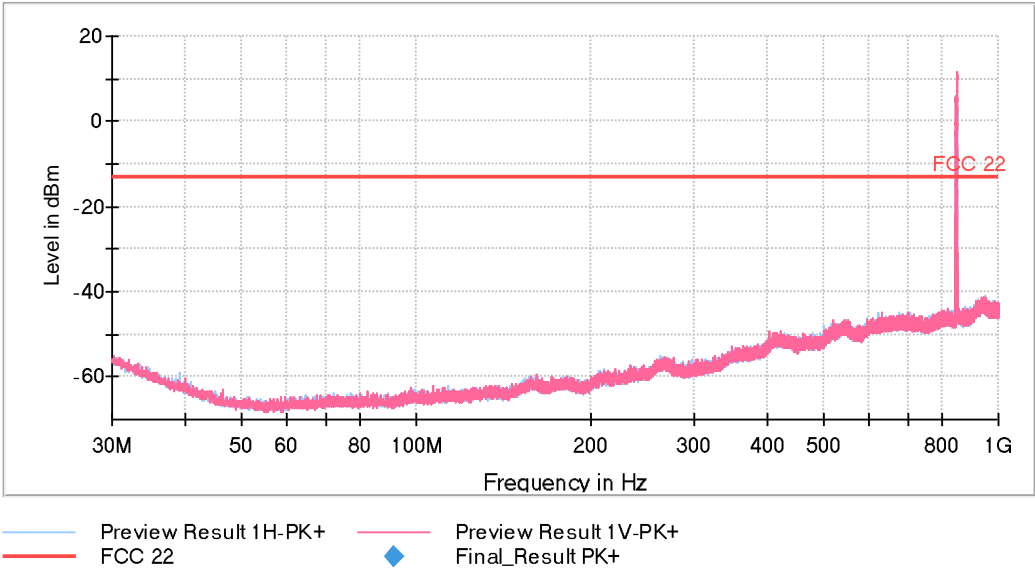
The peak above the limit is the carrier frequency.

- MIDDLE CHANNEL:



The peak above the limit is the carrier frequency.

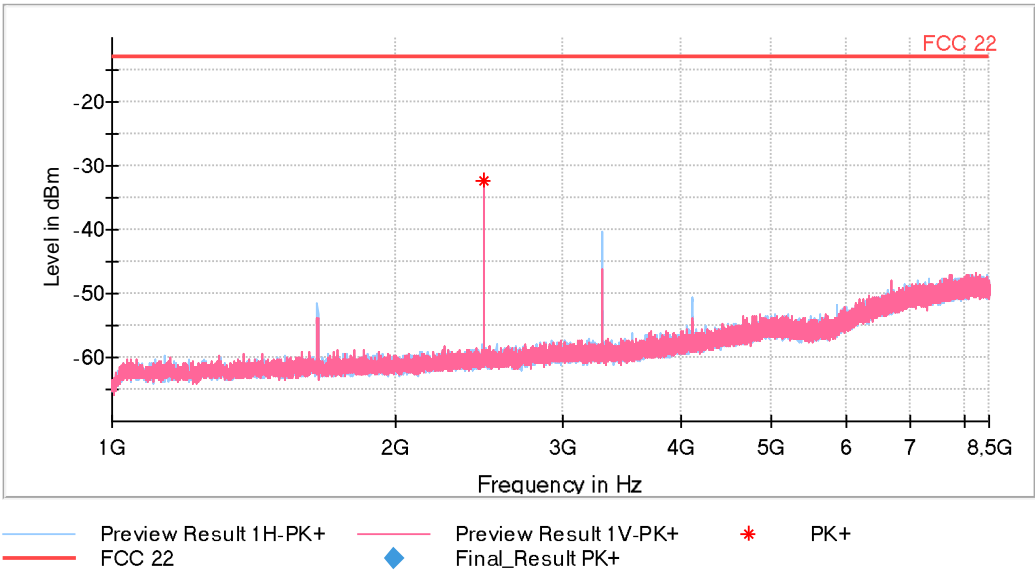
- HIGH CHANNEL:



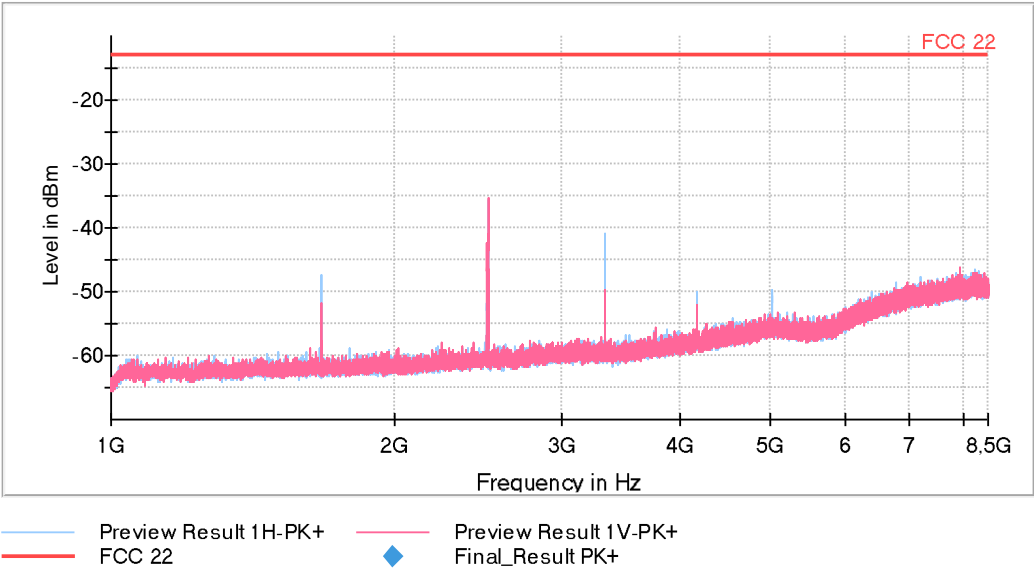
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 1 - 8.5 GHz:

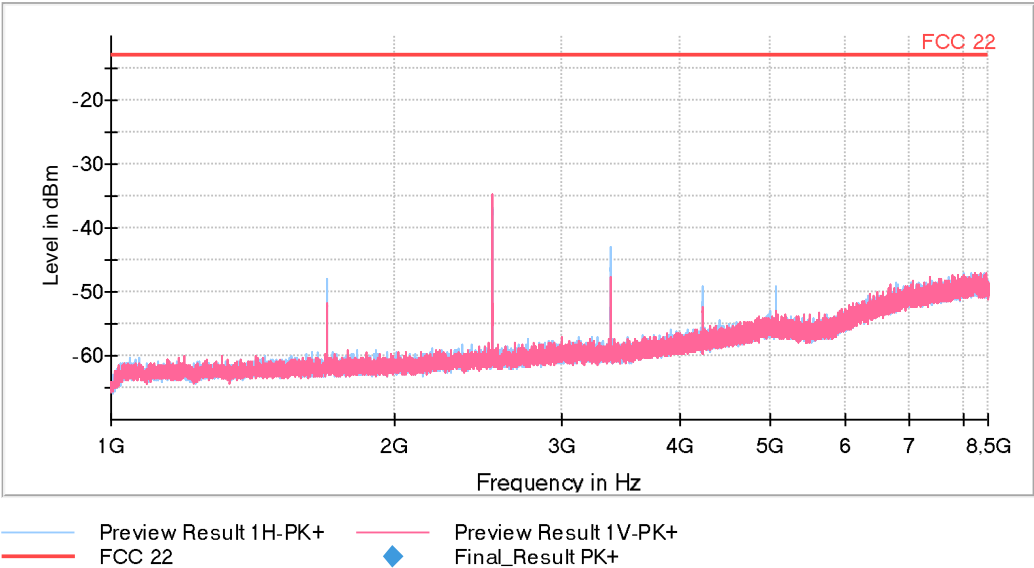
- LOW CHANNEL:



- MIDDLE CHANNEL:



- HIGH CHANNEL:



Appendix B: Test results for FCC 22 / RSS-132: LTE Cat NB1 Band 5

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TEST CONDITIONS

(*): Data provided by the Applicant.

POWER SUPPLY (*):

Vnormal: 9 Vdc

Type of Power Supply: Internal batteries.

ANTENNA (*):

Bands	Gain (dBi)	Type
LTE Cat NB1 Band 5	+4.3	Linear Polarization

TEST FREQUENCIES:

LTE Cat NB1 Band 5. Pi/2-BPSK, Pi/4-QPSK, QPSK modulations:

Channel. Number (Frequency, MHz)		
Low	Middle	High
20402 (824.20)*	20525 (836.50)	20648 (848.80)*
*The outermost channel which is in compliance with Block edge testing.		

Radiated Emissions

Limits

* FCC § 2.1051 and § 22.917:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

Compliance with these rules is based on the use of measurement instrumentation employing a reference bandwidth as follows:

In the spectrum below 1 GHz, instrumentation should employ a reference bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

- * RSS-132. 5.5: Mobile and base station equipment shall comply with the limits in (i) and (ii) below.
- In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} P$ (watts).
 - After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} P$ (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

Method

The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the high frequency generated within the equipment.

The EUT was placed on a 80 centimetres high non-conductive stand at a 3 meter distance from the measuring antenna.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the height and polarization of the measuring antenna. The maximum meter reading was recorded.

Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB, P in watts.

At P_o transmitting power, the specified minimum attenuation becomes $43+10\log (P_o)$, and the level in dBm relative P_o becomes:

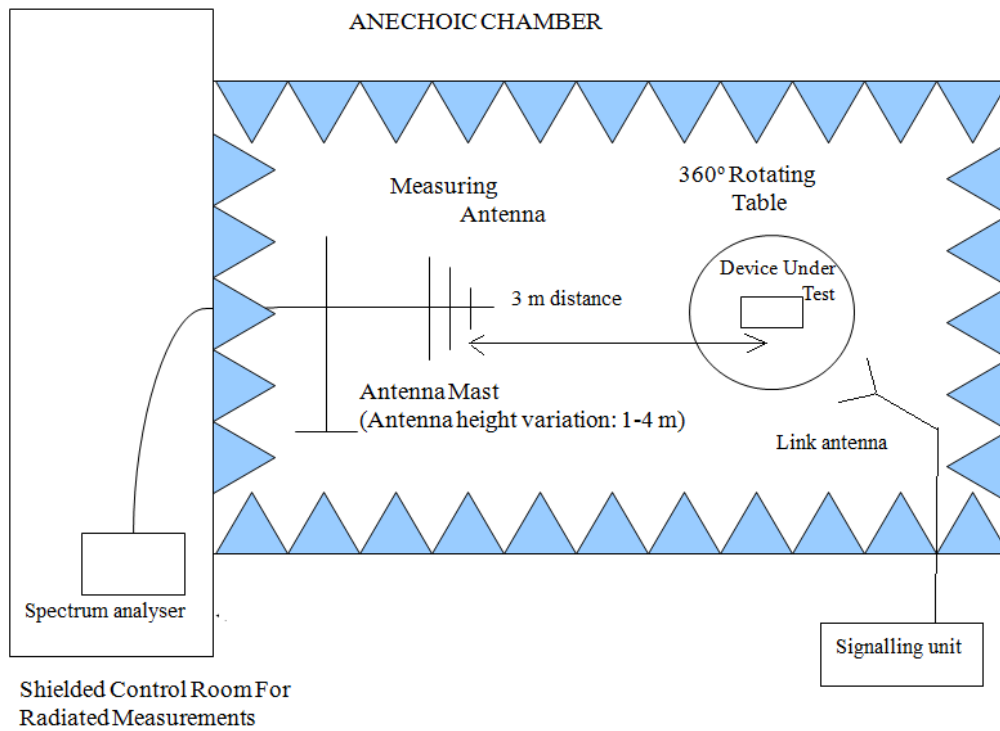
$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = - 13 \text{ dBm}$$

The maximum field strength (dBμV/m) of each detected emission at less than 20 dB respect to the limit is converted to an equivalent EIRP level (dBm) according to ANSI C63.26 with the formula:

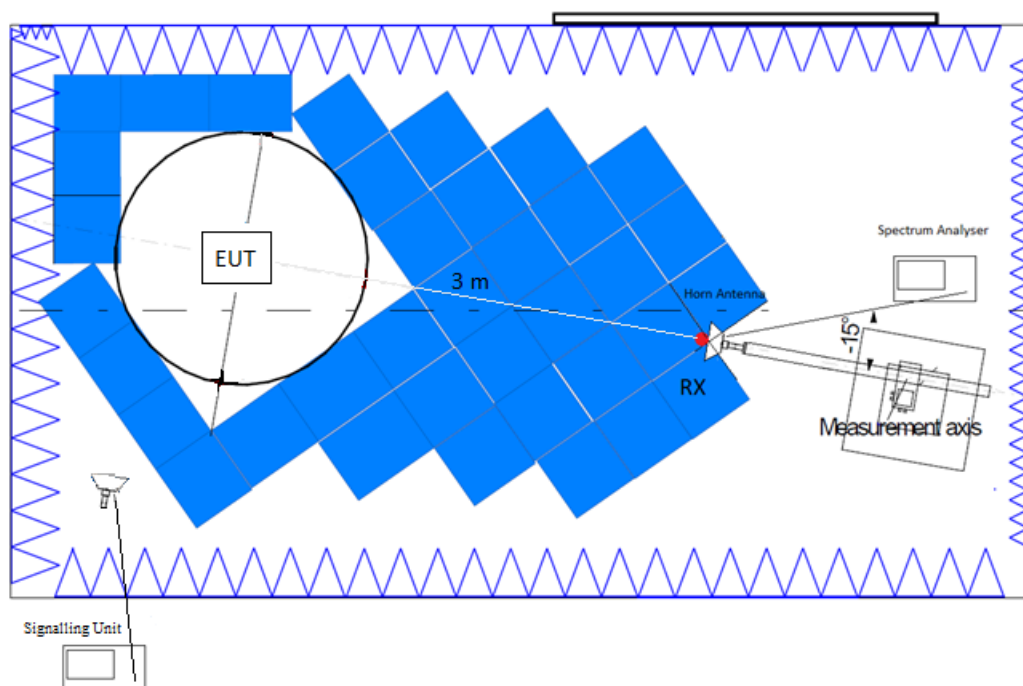
$EIRP \text{ (dBm)} = E \text{ (dBμV/m)} + 20 \log(D) - 104.8$; where D is the measurement distance (in the far field region) in m. D = 3 m

Test Setup

Radiated measurements below 1 GHz:



Radiated measurements above 1 GHz:



Results

LTE Cat NB1 Band 5:

A preliminary scan determined the Pi/4-QPSK, BW=15 kHz, Tone Number=3, Tone Offset=6, MSC/TBS=0 as the worst case. The following results are for this worst-case configuration.

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz - 8.5 GHz:

No spurious frequencies at less than 20 dB below the limit.

- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz - 8.5 GHz:

No spurious frequencies at less than 20 dB below the limit.

- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz - 8.5 GHz

No spurious frequencies at less than 20 dB below the limit.

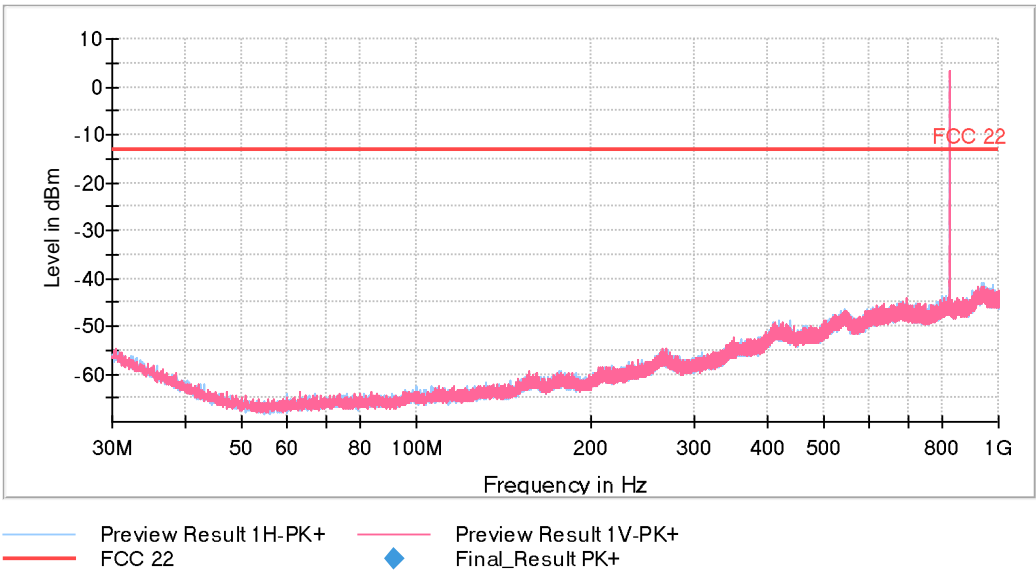
Measurement Uncertainty (dB):	<± 4.68 for $f \geq 30$ MHz up to 1 GHz
	<± 4.99 for $f \geq 1$ GHz up to 8.5 GHz

Verdict: PASS

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	1 MHz	1 s	0 dB
1 GHz - 8.5 GHz	234.375 kHz	PK+	1 MHz	1 s	0 dB

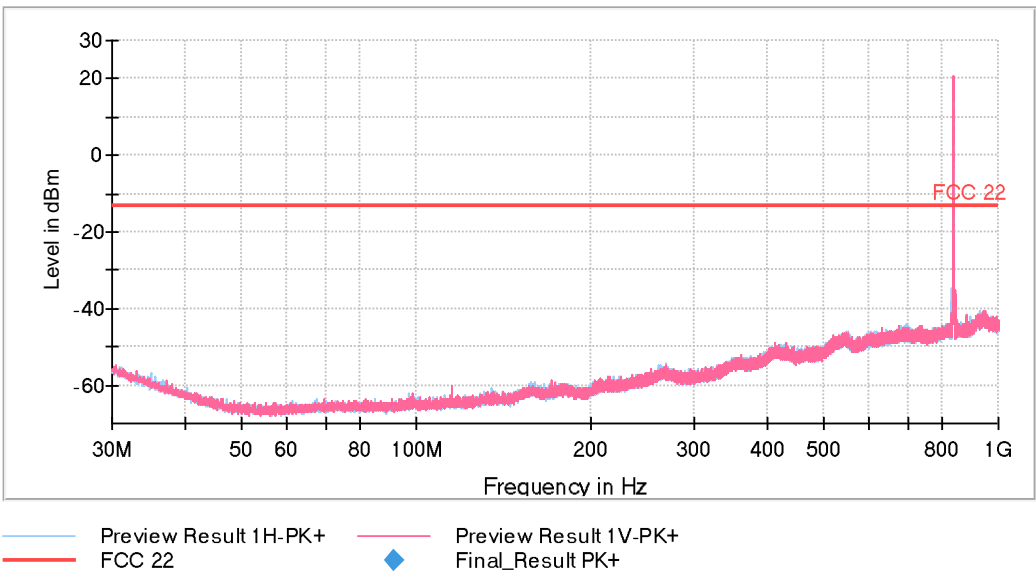
FREQUENCY RANGE 30 MHz - 1 GHz:

- LOW CHANNEL:



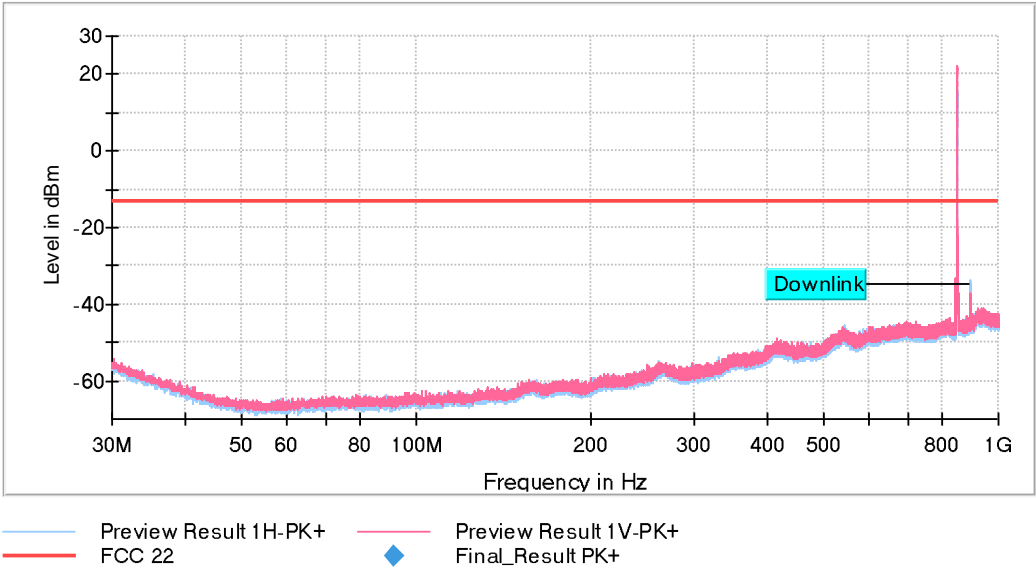
The peak above the limit is the carrier frequency.

- MIDDLE CHANNEL:



The peak above the limit is the carrier frequency.

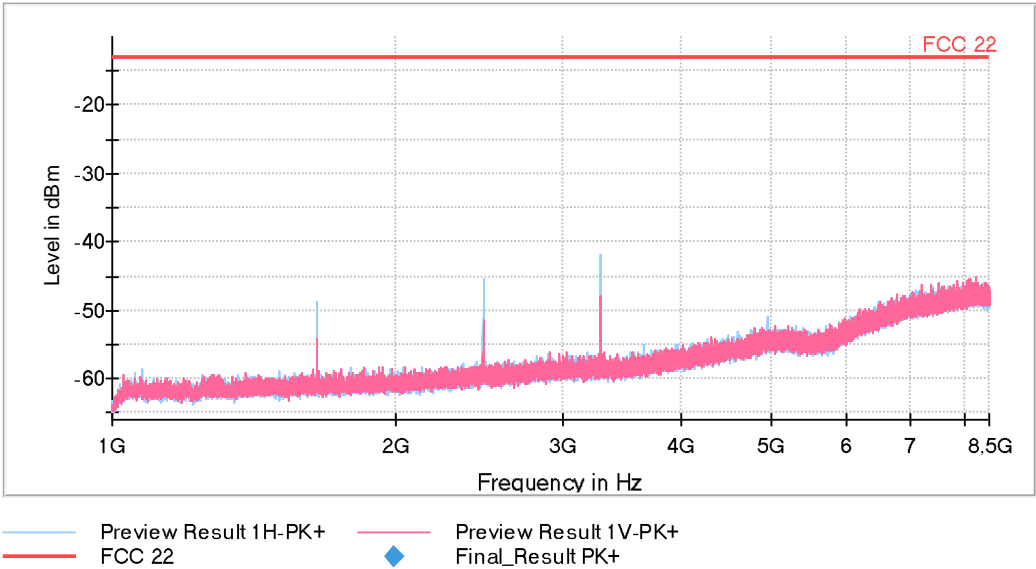
- HIGH CHANNEL:



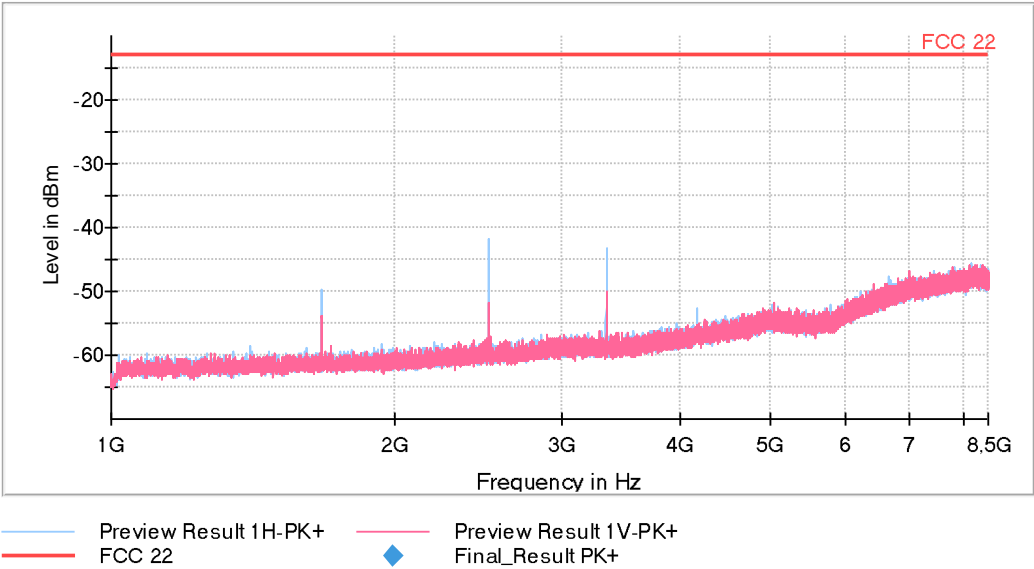
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 1 GHz - 8.5 GHz:

- LOW CHANNEL:



- MIDDLE CHANNEL:



- HIGH CHANNEL:

