Bluetooth (Basic rate/EDR)

FCC Test Report

FOR:

HAP Innovations

Model Name: Spencer

Product Description:
Smart In-Home Medication Dispenser

FCC ID: 2AIA7-SPN01

47 CFR Part 15.247

TEST REPORT #: EMC_HAPIN-001-16501_15.247_FHSS_rev2
DATE: 2016-08-22

A2LA Accredited

IC recognized #
3462B

***CETECOM* Inc.**
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CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

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1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations. No deviations were ascertained.

Company	Description	Model #
HAP Innovations	Smart In-Home Medication Dispenser	sp.01

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2016-08-22	Compliance	Franz Engert (Compliance Manager)	Digitally signed by Franz Engert DN: cn=Franz Engert, c=US, o=CETECOM, ou=Complience, email=franz.engert@cetecom.com

Responsible for the Report:

Date	Section	Name	Signature
2016-08-22	Compliance	Douglas Antioco (EMC Engineer)	Douglas Antioco 2016.08.22 19:15:43 -07'00'

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Compliance Manager:	Franz Engert
Responsible Project Leader:	Douglas Antioco

2.2 Identification of the Client

Applicant's Name:	Device Solutions
Street Address:	1004 Copeland Oaks Dr.
City/Zip Code	Morrisville, NC 27560
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	HAP Innovations
Manufacturers Address:	4220 Apex Highway, Suite 200
City/Zip Code	Durham, NC 27713
Country	USA

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Model No:	sp.01
HW Version :	1.0
SW Version :	1.0
FCC-ID :	2AIA7-SPN01
HVIN:	Sp.01
PMN:	spencer
Product Description:	Smart In-Home Medication Dispenser
Frequency Range / number of channels:	Nominal band: 2400 – 2483.5; Center to center: 2402(ch 0) – 2480(ch 78), 79 channels
Type(s) of Modulation:	Bluetooth Basic/EDR: GFSK, π /4 DQPSK, 8DPSK
Modes of Operation:	Hopping
Integrated Module Info:	TI WL1835MOD WiLink™ 8 single band combo 2x2 MIMO Wi-Fi®, Bluetooth® & Bluetooth Smart (Low energy) module (FCC ID: Z64-WL18SBMOD / IC ID: 451I-WL18SBMO) • Bluetooth Low Energy with GFSK modulation • Bluetooth EDR/BDR with GFSK, π/4 DPSK, and 8 DPSK Modulations • 802.11 b/g/n (2.4GHz)
Antenna Information as declared:	Internal Antenna: Documented max antenna gain (2.4GHz) = 3.6 dBi
Max. Output Powers:	Measured Conducted Power: 12.4 dBm (Peak) with GFSK
Power Supply/ Rated Operating Voltage Range:	Li-ion battery pack (dedicated) Vmin: 11.5V dc/ Vnom: 12.0V dc / Vmax: 16.8V dc
operating temperature range	5 ºC to 40 ºC
Other Radios included in the device:	BTLE 4.0 802.11 b/g/n (2.4GHz) LTE (Band 4 and 13)
Prototype / Production unit	Prototype

Note: Obtained from section 3.5.5 of the module report. Please see section 5.5 of this report..

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	010C0319160300002E	1.0	1.0	Radiated Emissions

3.3 Identification of Ancillary equipment

STE #	Type	Manufacturer	Model	Serial Number	Notes/Comments
1	Laptop	Dell	E5440	N/A	Used to Stimulate Radio

3.4 Environmental conditions during Test:

The following environmental conditions were maintained during the course of testing:
Ambient Temperature: 20-25^{o}C
Relative humidity: 40-60%

3.5 Dates of Testing:

2016/05/09-2016/08/22

3.6 Test mode of operation with multiple modulations:

1. The channels and modulation schemes of the EUT was set with a >98% Duty Cycle using special software that is not available to the end user.

3.7 Subject of Investigation

The objective of the evaluation documented in this report was to assess if the performance of the EUT meets the relevant requirements specified in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations.

This test report is to support a request for new equipment authorization under the FCC ID: 2AIA7-SPN01

All testing was performed on the product referred to in Section 3 as the EUT.

During the testing process the EUT was tested with transmitter sets on the middle channel. For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

Testing procedures are based on Public Notice "DA 00-705: March 30, 2000" and ANSI C63.10:2013 for FHSS systems.

An evaluation has been carried out for GFSK, 8-DPSK and π/4-DQPSK modulation with >98% Duty Cycle.

4 Summary of Measurement Results

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§15.247(b)(1)	Maximum Peak Conducted Output Power	Nominal	N/A	☐	☐	☐	■	See Note 1
§15.247(d)	Band Edge Compliance	Nominal	N/A	☐	☐	☐	■	See Note 1
§15.247(a)(1)	Spectrum Bandwidth	Nominal	N/A	☐	☐	☐	■	See Note 1
§15.247(a)(1)	Carrier Frequency Separation	Nominal	N/A	☐	☐	☐	■	See Note 1
§15.247(a)(1)	Number of Hopping Channels	Nominal	N/A	☐	☐	☐	■	See Note 1
§15.247(a)(1)(iii)	Time of occupancy	Nominal	N/A	☐	☐	☐	■	See Note 1
§15.247(d) §15.209 (a)	TX Spurious emissions-Radiated	Nominal	GFSK QPSK 8DPSK	■	☐	☐	☐	Complies
§15.207(a)	AC Conducted Emissions <30MHz	Nominal	GFSK QPSK 8DPSK	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.
Note 1: Leveraged from module certification. See Section 5.5.

5 Measurements

5.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=1.

Radiated measurement:

	Uncertainty in dB Radiated <30MHz	Uncertainty in dB Radiated 30MHz - 1GHz	Uncertainty in dB Radiated > 1GHz
Standard Deviation k=1	**2.48**	**1.94**	**2.16**
95% Confidence Interval in dB	**4.86**	**3.79**	**4.24**
95% Confidence Interval in dB in Delta to Result	**+/-2.5 dB**	**+/-2.0 dB**	**+/- 2.3dB**

Conducted measurement:

150 kHz to 30 MHz ±0.7 dB (LISN)

RF conducted measurement ±0.5 dB

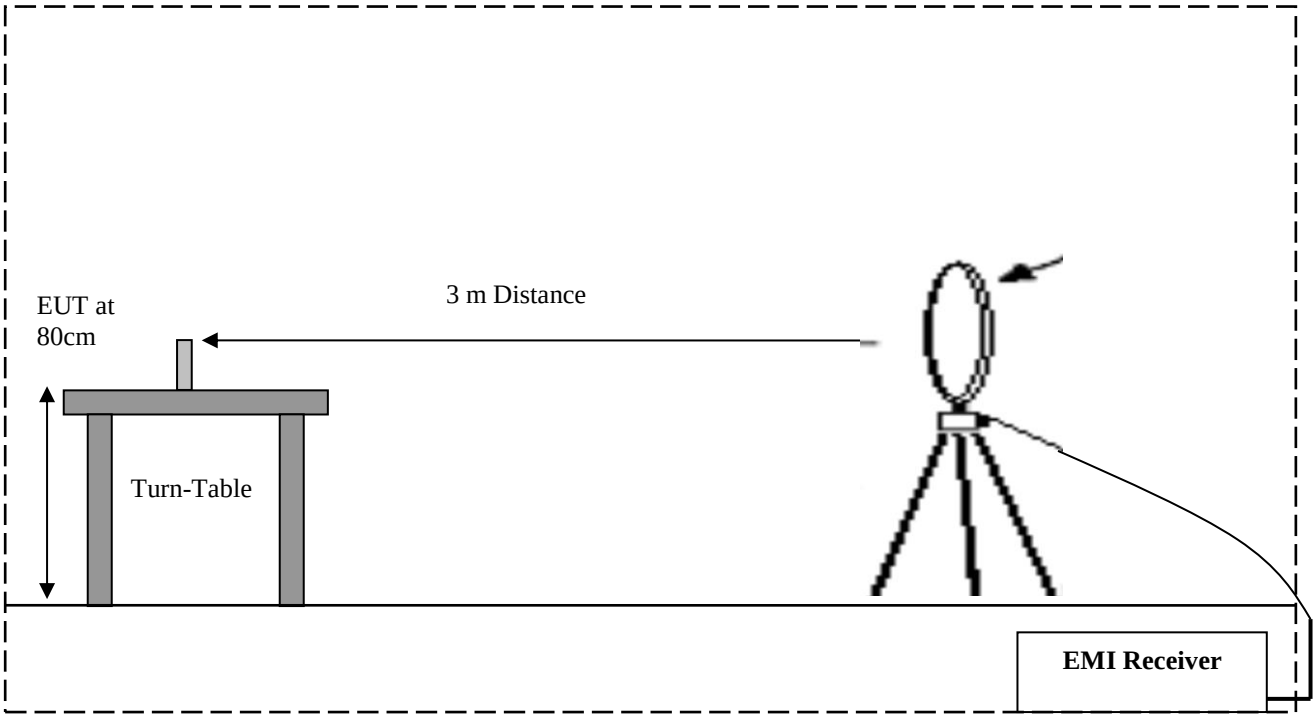
According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: http://physics.nist.gov/cuu/Uncertainty/typeb.html. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3dB to the limit.

5.2 Radiated Measurement Procedure

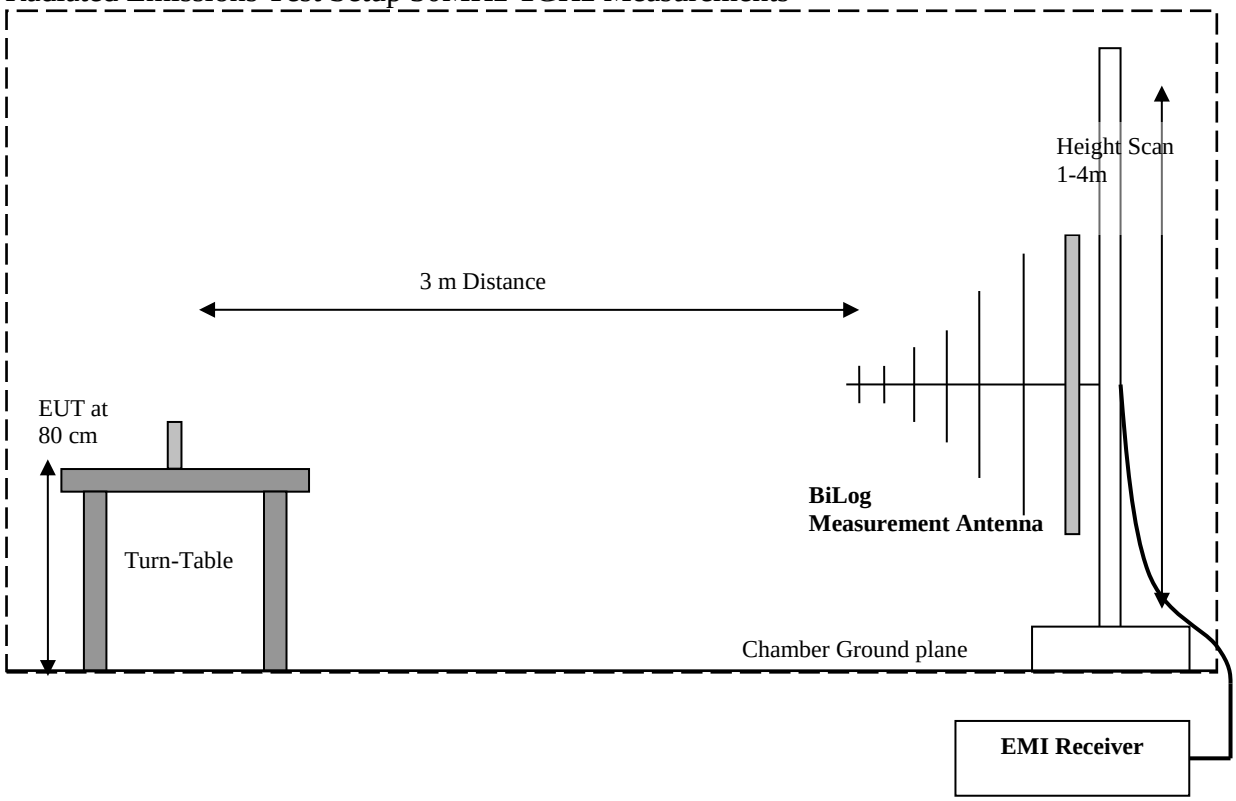
The radiated measurement is performed according to:
ANSI C63.10 (2013)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9kHz to 30MHz, a Biconlog antenna is used from 30MHz to 1GHz, two different horn antennas are used to cover frequencies up to 40GHz.

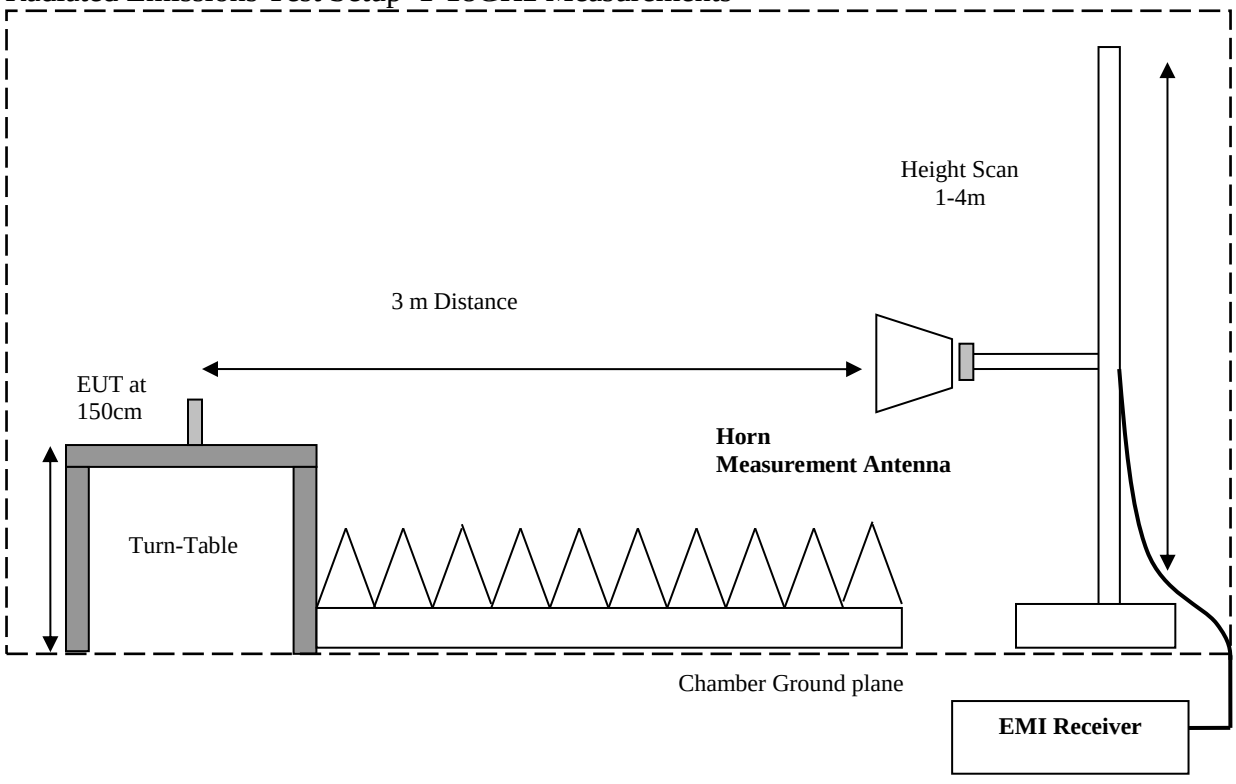
Radiated Emissions Test Setup below 30MHz Measurements



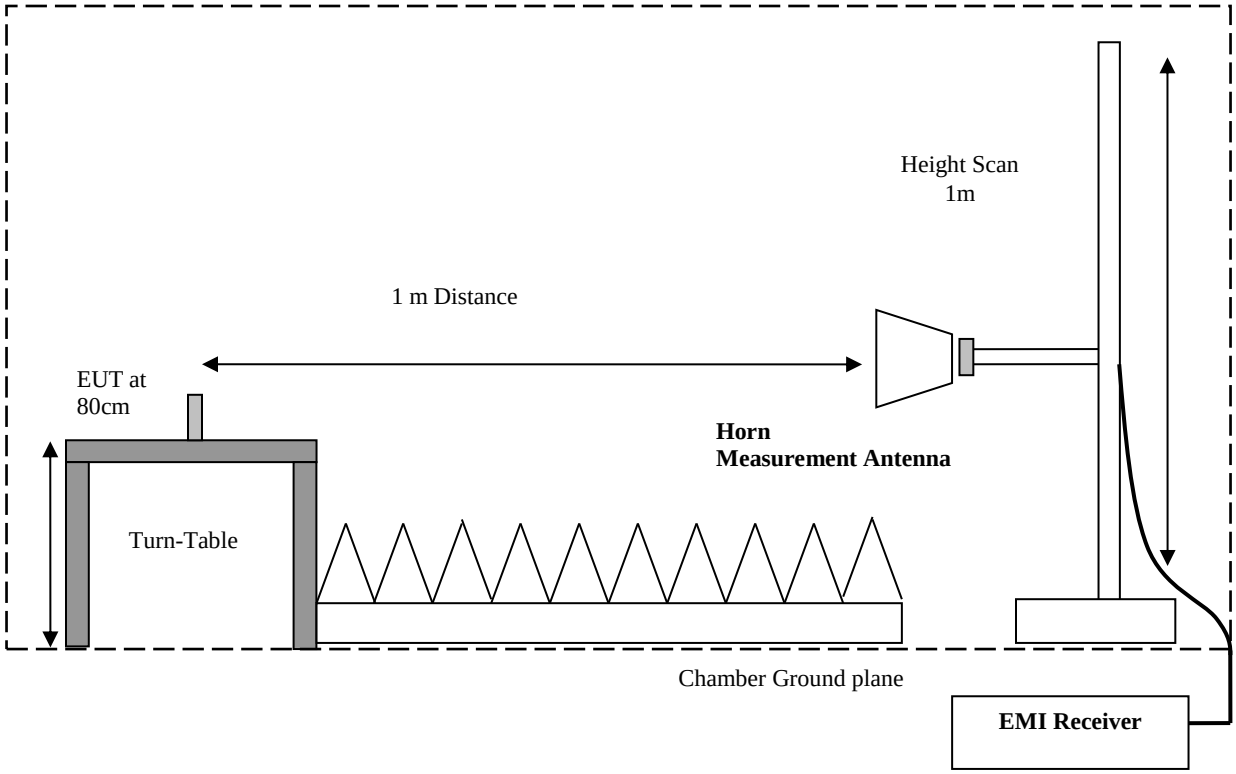
Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup 1-18GHz Measurements



Radiated Emissions Test Setup 18-26GHz Measurements



5.3 Sample Calculations for Radiated Measurements

5.3.1 Field Strength Measurements:

Measurements from the Spectrum Analyzer/ Receiver are used to calculate the Field Strength, taking into account the following parameters:

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

FS (dBµV/m) = Measured Value on SA (dBµV)- Cable Loss (dB)+ Antenna Factor (dB/m)
Eg:

Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the above equation.

5.4 Conducted Emissions Measurement Procedure (AC Power Line)

Conducted Emissions measurements done according to:

ANSI C63.10 (2013)

5.5 Inheriting Test Results from Incorporated Module Certification:

The EUT integrates the certified module TI WL1835MOD (details see EUT specifications in section 3.1)

Taking into account guidance from FCC KDB 996369 (modular approval) and where relevant test procedures did not change, conducted test results are leveraged from the test report for the TI WL1835MOD given by Sporton International Inc., dated January 27, 2014 with Report Reference Number: FR3N2752-01A; FCC ID: Z64-WL18SBMOD.

This test report contains full radiated testing as per FCC 15.247.

6 Technical Specifications Requirements

6.1 Maximum Conducted Peak Output Power Verification

6.1.1 Measurement settings

Conducted measurements were taken according to ANSI C63.10-2013 Section 11.9.1.1 using equipment number 19 in section 7.

6.1.2 Limits:

- The measured output power shall be within +0.2dB and -1dB from the modular report power.
- The power measured on the mid channel of the RF band of operation will be compared to the Max. Output Power from the modular reports as referenced in section 5.5.

6.1.3 Test conditions and setup:

Equipment number 19 in section 7 of this report was used for this test case.

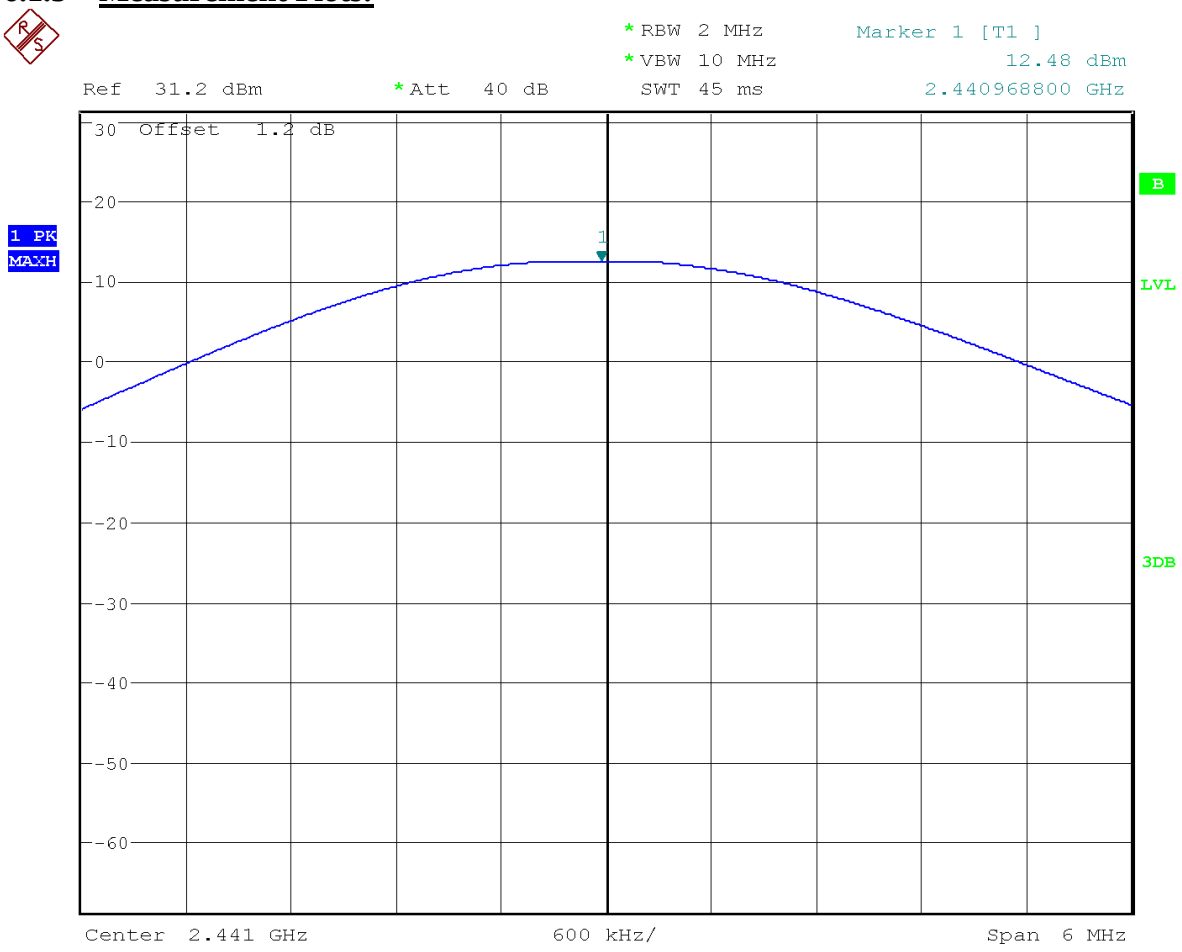
Only the mode with the highest output power from the modular report referenced in section 5.5 was verified.

Ambient Temperature	EUT operating mode	Antenna Gain
22° C	GFSK	3.6

6.1.4 Measurement result:

Frequency (MHz)	Mode	Maximum Conducted Peak Output Power (dBm)	Conducted Peak Output Power From Modular Report (dBm)	Output Power Delta (dB)	Result
2441	GFSK	12.5	12.4	+ 0.1	Pass

6.1.5 Measurement Plots:



Date: 22.AUG.2016 17:13:19

6.2 Transmitter Spurious Emissions & Restricted Bands- Radiated

6.2.1 Limits:

§15.247/15.205/15.209 & RSS-Gen 8.9/ 8.10 (restricted bands)
(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

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

*PEAK LIMIT= 74dBµV/m
*AVG. LIMIT= 54dBµV/m

Table 1:

Frequency of emission (MHz)	Field strength @ 3m (µV/m)	Field strength @ 3m (dBµV/m)
30–88	100	40dBµV/m
88–216	150	43.5 dBµV/m
216–960	200	46 dBµV/m
Above 960	500	54 dBµV/m

Table 2:

Frequency of emission (MHz)	Field strength (µV/m) / (dBuV/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 / (29.5)	30

Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements described in 5.2.
The highest (or worst-case) data rate shall be recorded for each measurement.

When testing at other than specified distance in the standard, the approach calculation by using 40 dB/decade extrapolation factor equation (4) as follow:

Conversion factor (CF) = 40 log (D/d) = 40 log (300m / 3m) = 80dB

6.2.2 Test Conditions

Tnom: 23°C; Vnom: 120VAC

6.2.3 Test Procedure

Measurement according to:
ANSI C63.10 (2013)

Please see section 5.1 for detailed test setup. Equipment numbers 1-16 in section 7 of this report were used for this test case in a semi-anechoic chamber.

Analyzer Settings:
From 9 KHz – 30 MHz
RBW = 9 KHz
Detector: Peak

From 30 MHz – 1 GHz
Detector = Peak / Quasi-Peak
RBW=120 KHz (<1GHz)

Above 1 GHz
Detector = Peak / Average
RBW= 1MHz

Test mode: *Modulation:* GFSK, π/4-DQPSK and 8-DPSK- the highest conducted output power from the peak and average measurements

Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmit signal.
Plots reported here represent the worst case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT.

Only mid channel was tested as the difference in output power between the mid channel and low and high channels of the module certification report referenced in section 5.5 is within the measurement uncertainty for conducted measurements.

6.2.4 Measurement Result:

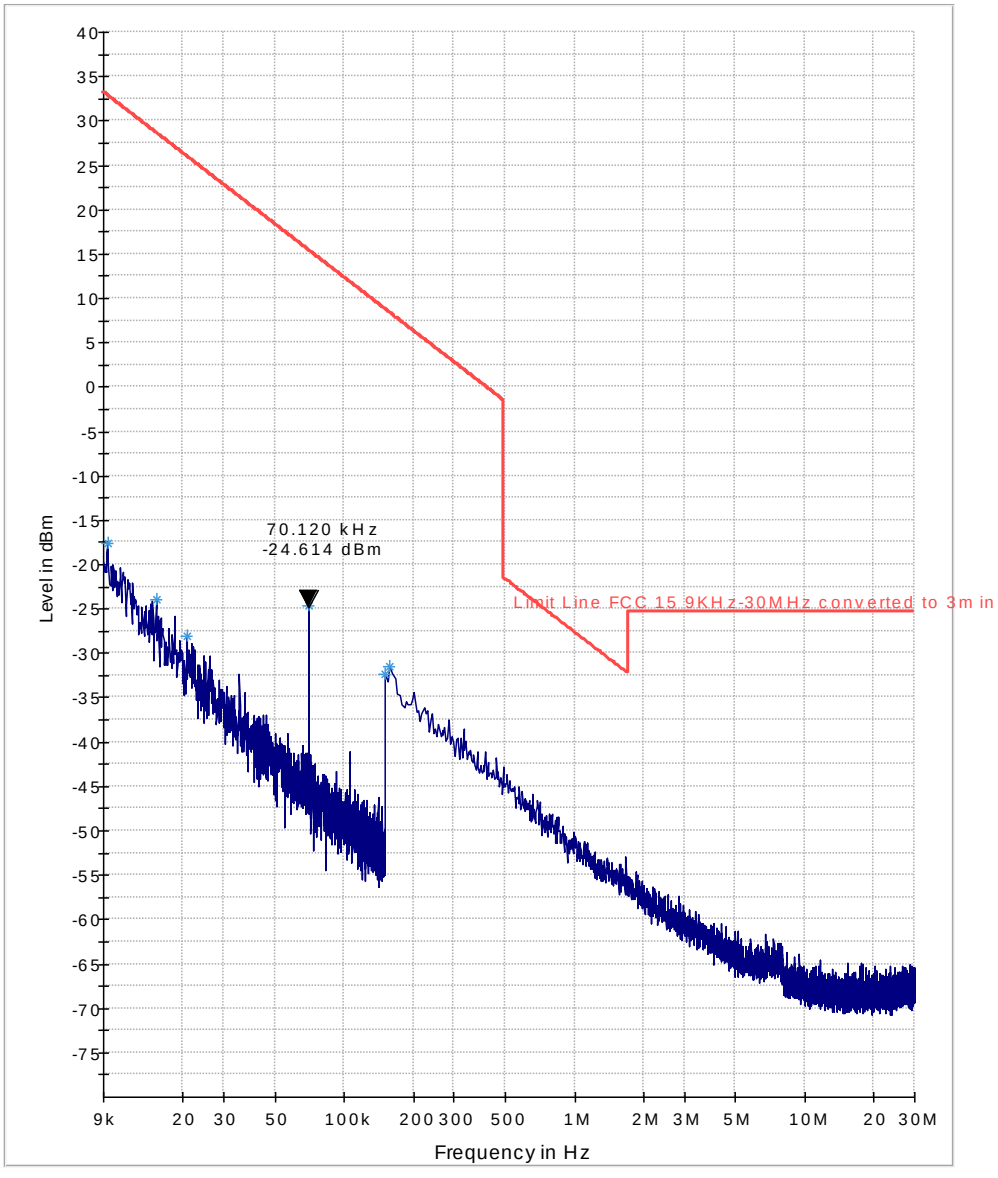
Pass.

6.2.5 Measurement plots:

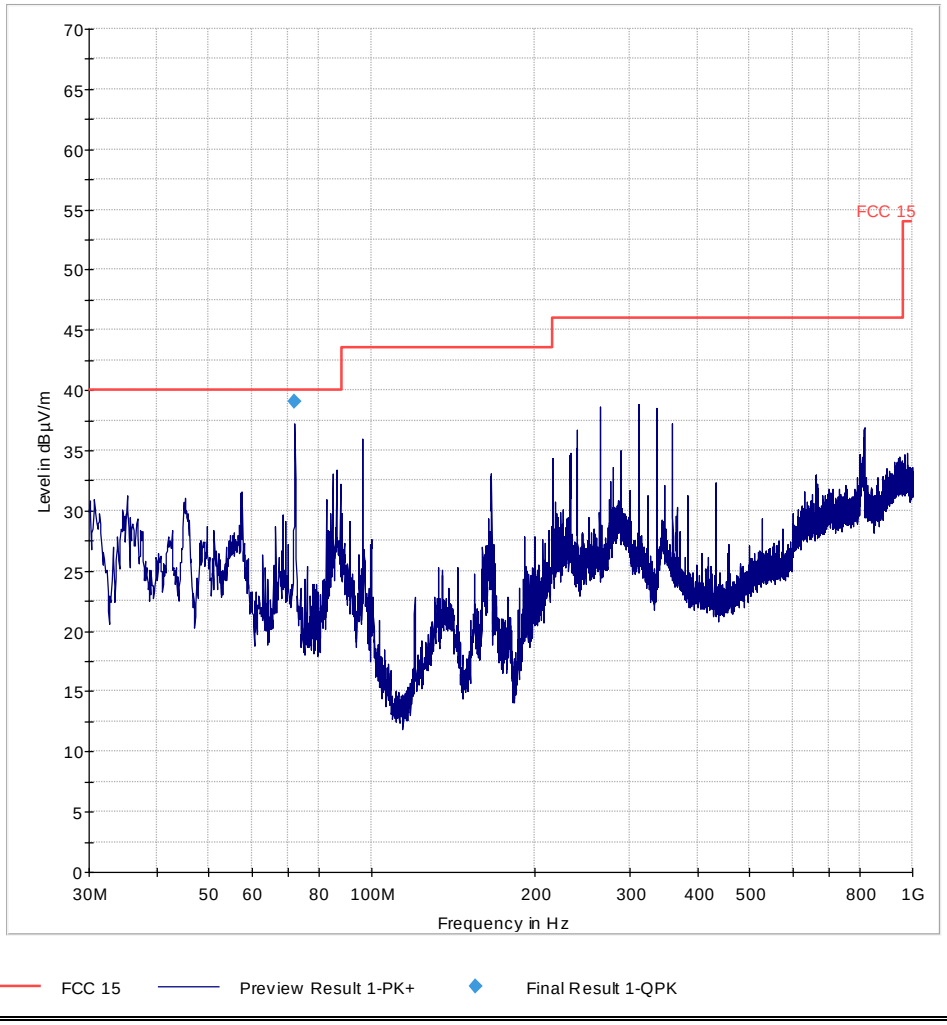
Note: Worst case representation for all modes of operation in this frequency range. Limits adjusted for 3m measurement.

6.2.5.1 GFSK

Radiated Emissions: 9 KHz - 30 MHz		
Modulation: GFSK	**Channel: 39**	**>98% Duty Cycle**



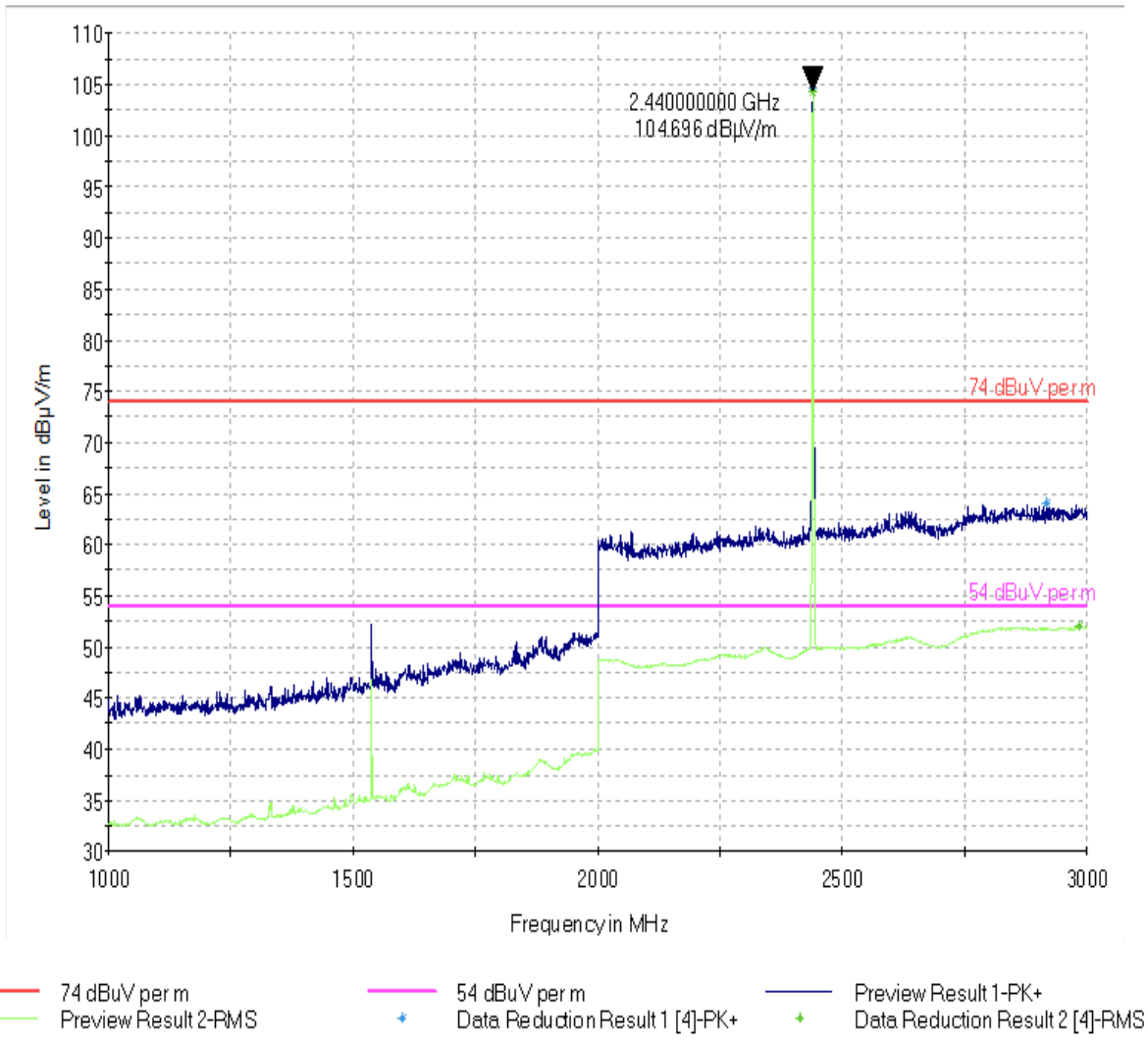
Radiated Emissions: 30 MHz – 1GHz		
Modulation: GFSK	**Channel: 39**	**>98% Duty Cycle**



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
72.080000	39.1	100.0	120.000	313.0	V	91.0	8.7	0.9	40.0

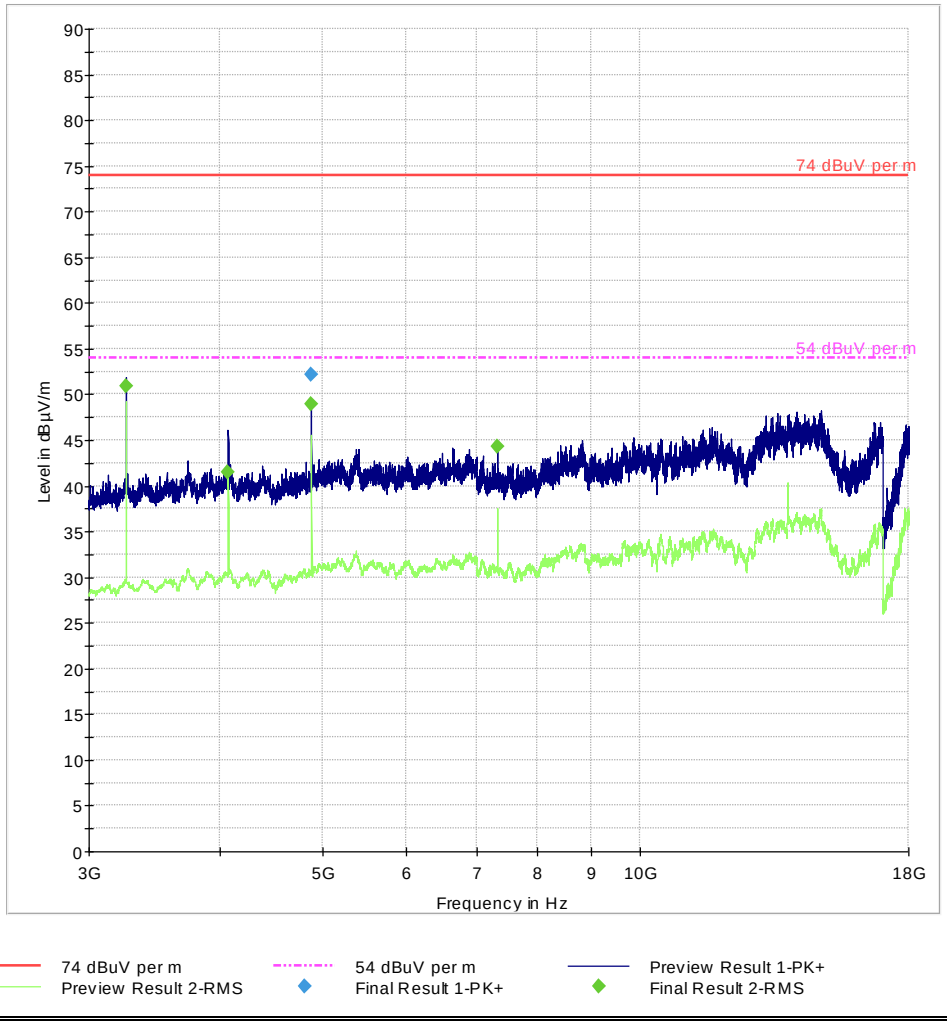
Disclaimer: Any measurement data within 2dB from the limit line is conditional PASS/FAIL due to measurement uncertainty considerations.

Radiated Emissions: 1-3 GHz		
Modulation: GFSK	**Channel: 39**	**>98% Duty Cycle**



Note: Emission above limit is the Tx Signal

Radiated Emissions: 3-18 GHz		
Modulation: GFSK	**Channel: 39**	**>98% Duty Cycle**



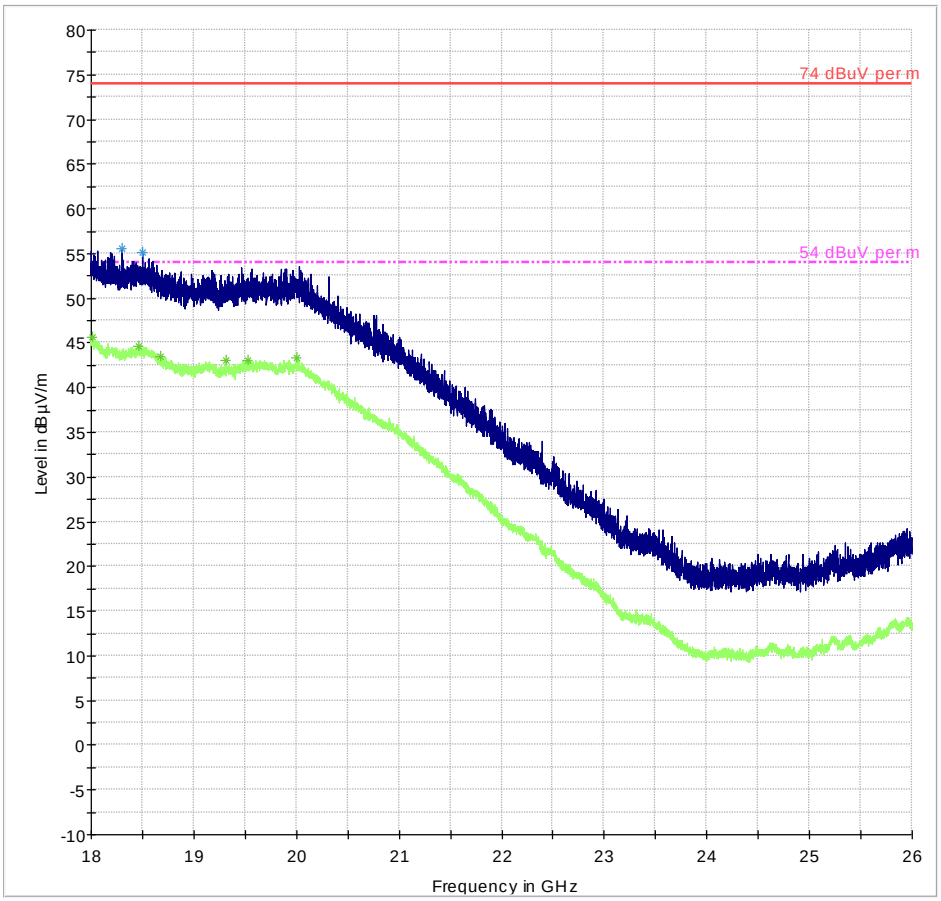
Final Result 1

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4881.700000	52.2	100.0	1000.000	154.0	V	213.0	-18.2	21.8	74.0

Final Result 2

Frequency (MHz)	RMS (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
3255.000000	50.9	100.0	1000.000	155.0	V	238.0	-22.7	3.1	54.0
4068.000000	41.5	100.0	1000.000	140.0	V	238.0	-20.5	12.5	54.0
4882.000000	48.9	100.0	1000.000	159.0	V	215.0	-18.2	5.1	54.0
7323.000000	44.3	100.0	1000.000	150.0	V	55.0	-11.8	9.7	54.0

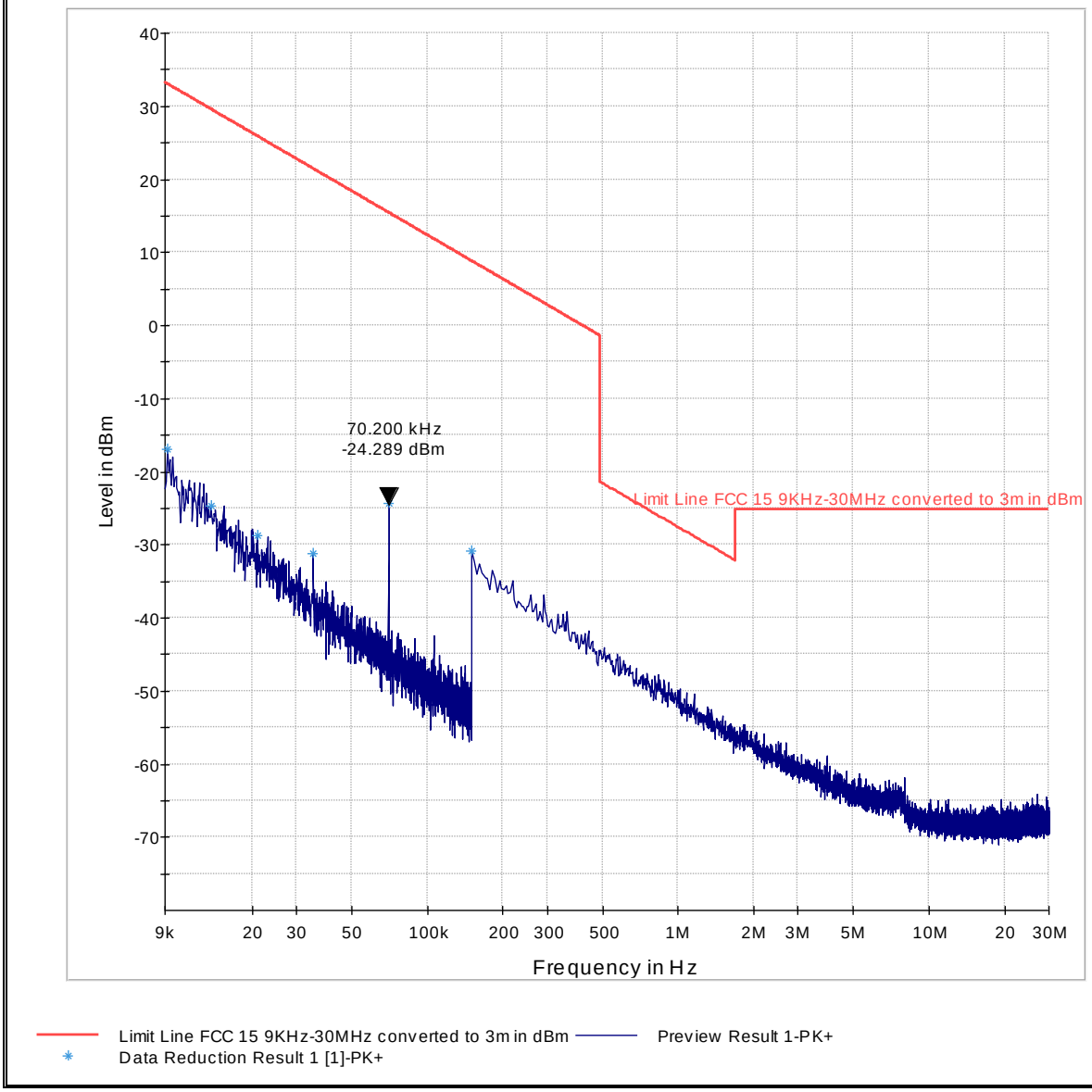
Radiated Emissions: 18-26 GHz		
Modulation: GFSK	**Channel: 39**	**>98% Duty Cycle**



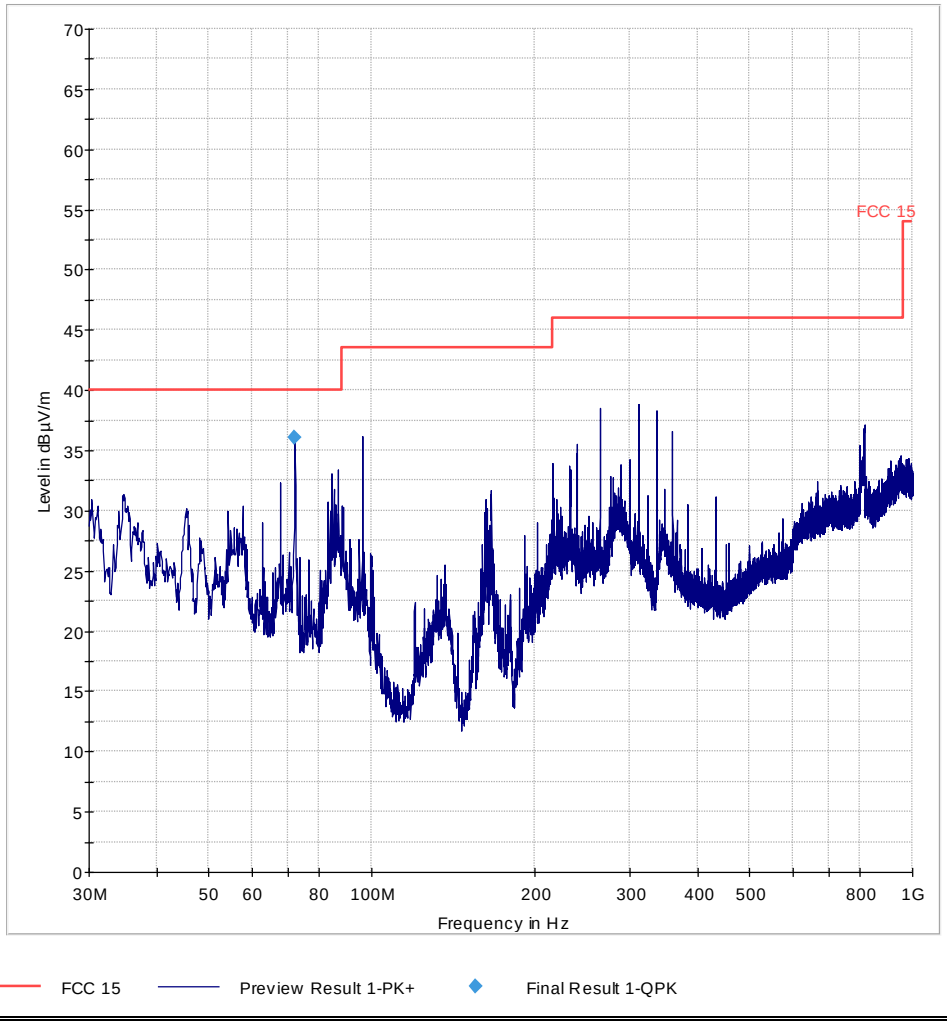
74 dBuV per m
Preview Result 1-PK+
Data Reduction Result 1 [6]-PK+
54 dBuV per m
Preview Result 2-RMS
Data Reduction Result 2 [6]-RMS

6.2.5.2 8-DPSK

Radiated Emissions: 9 KHz - 30 MHz		
Modulation: 8-DPSK	**Channel: 39**	**>98% Duty Cycle**

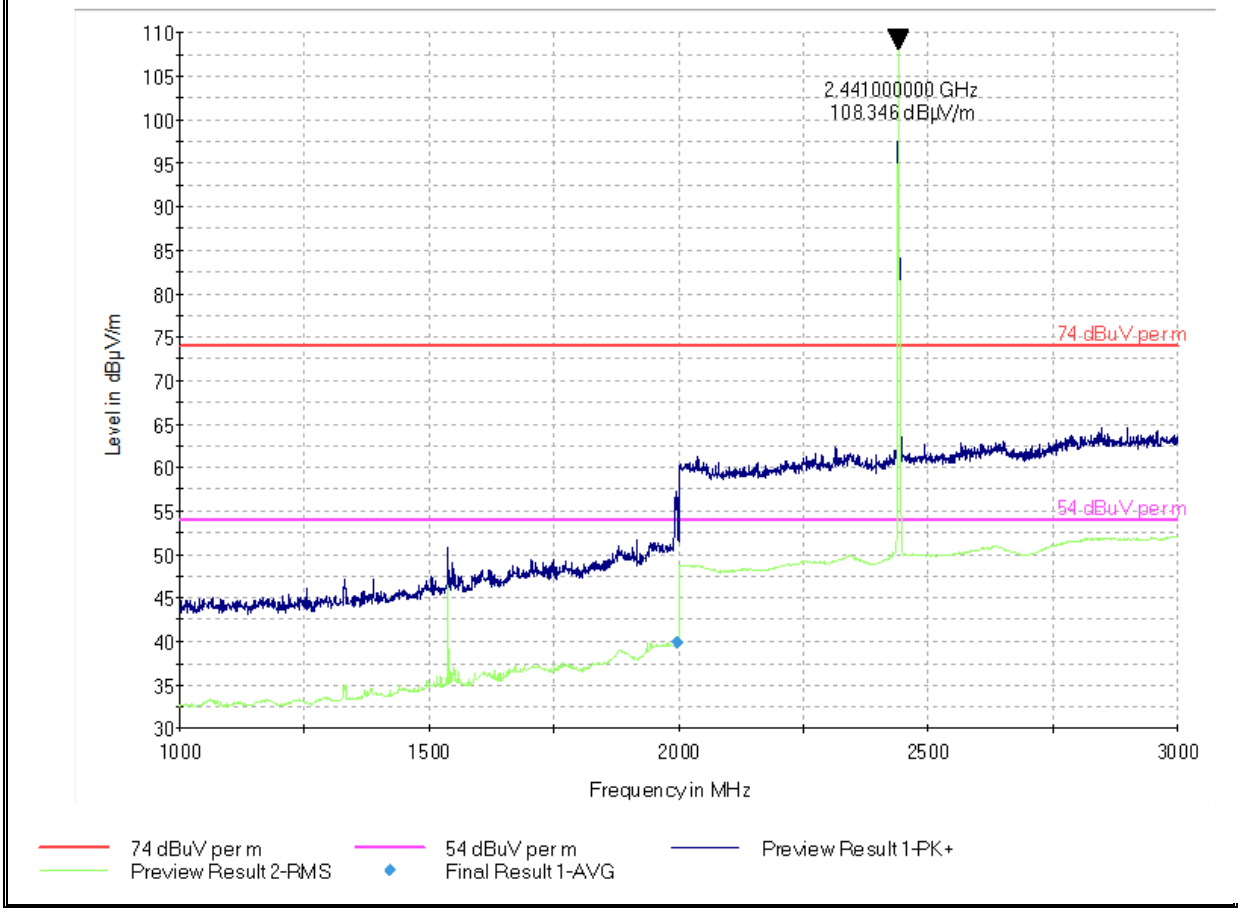


Radiated Emissions: 30 MHz – 1GHz		
Modulation: 8-DPSK	**Channel: 39**	**>98% Duty Cycle**



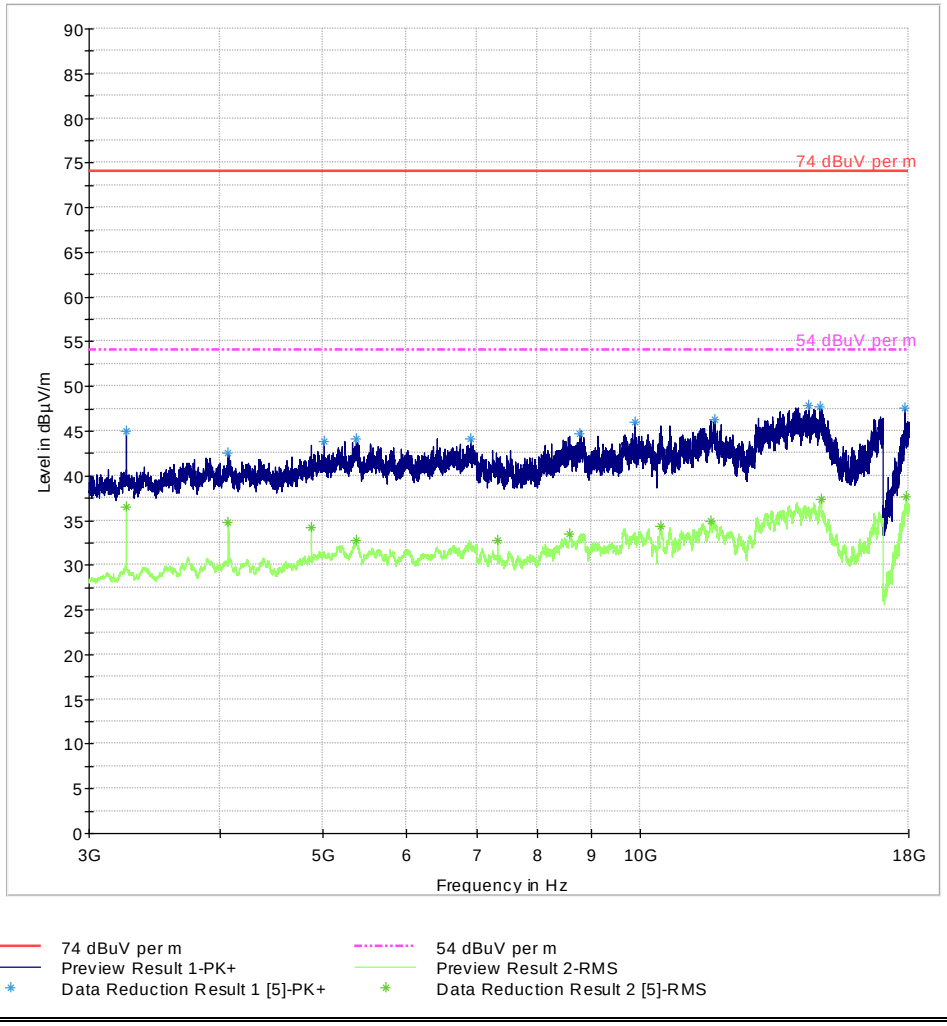
Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
72.080000	36.1	100.0	120.000	216.0	V	164.0	8.7	3.9	40.0

Radiated Emissions: 1-3 GHz		
Modulation: 8-DPSK	**Channel: 39**	**>98% Duty Cycle**

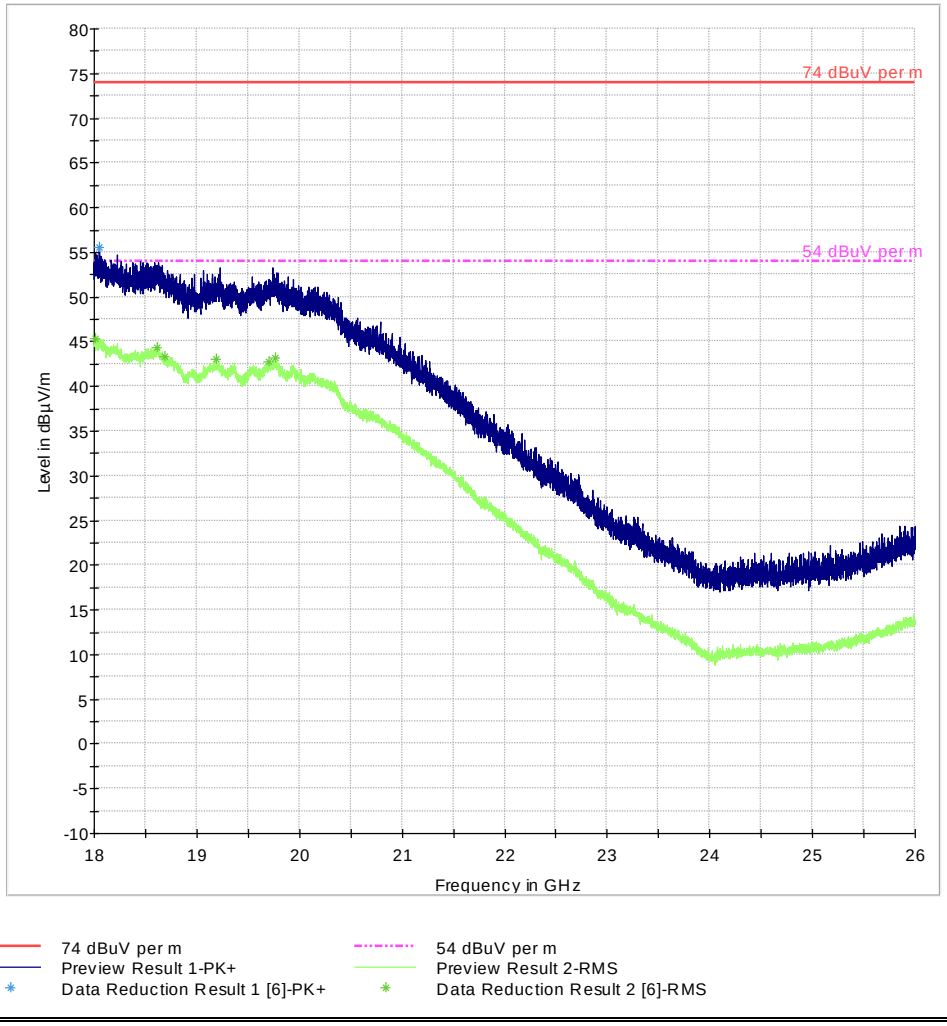


Note: Emission above limit is the Tx Signal

Radiated Emissions: 3-18 GHz		
Modulation: 8-DPSK	**Channel: 39**	**>98% Duty Cycle**

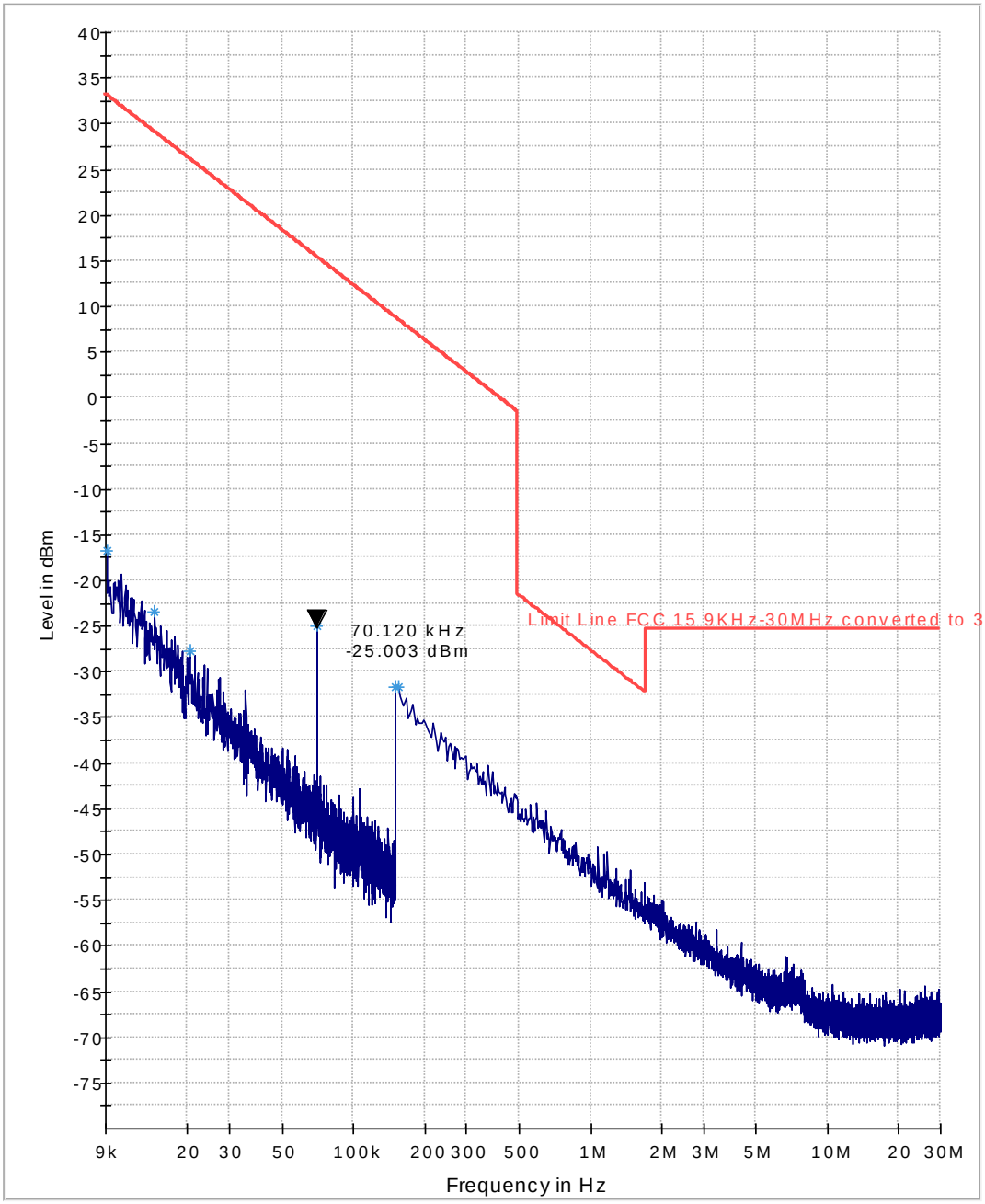


Radiated Emissions: 18-26 GHz		
Modulation: 8-DPSK	**Channel: 39**	**>98% Duty Cycle**

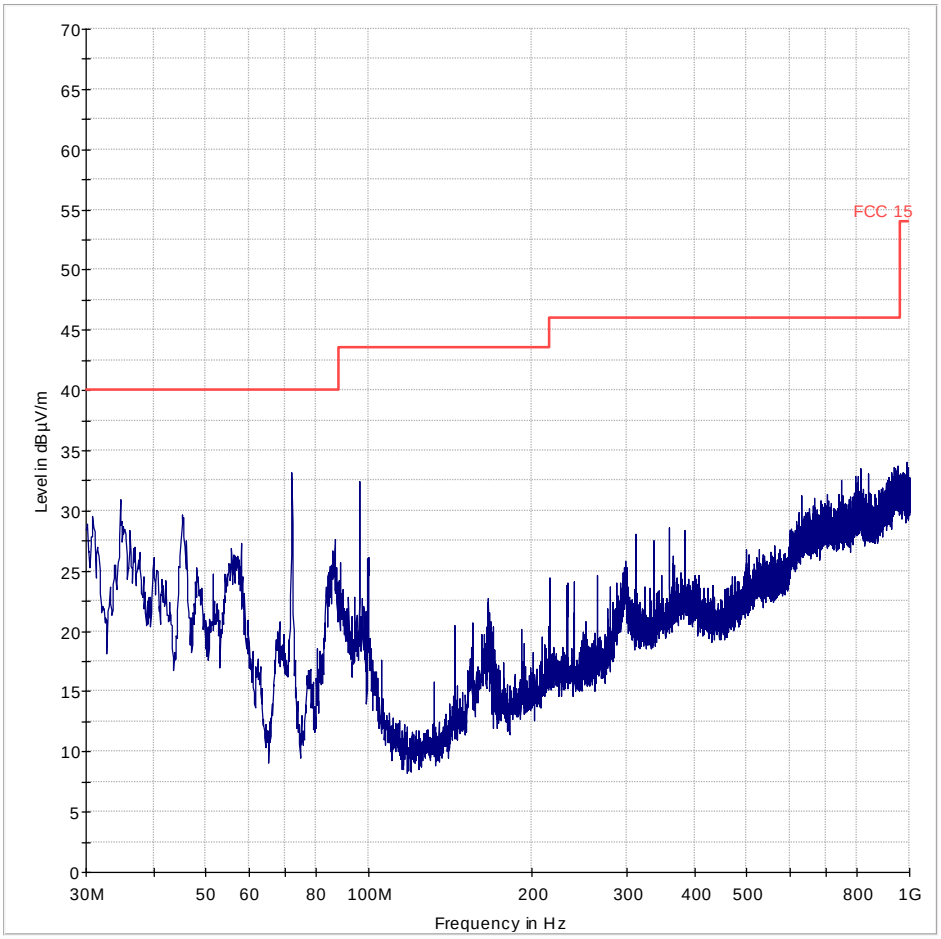


6.2.5.3 π/4-DQPSK

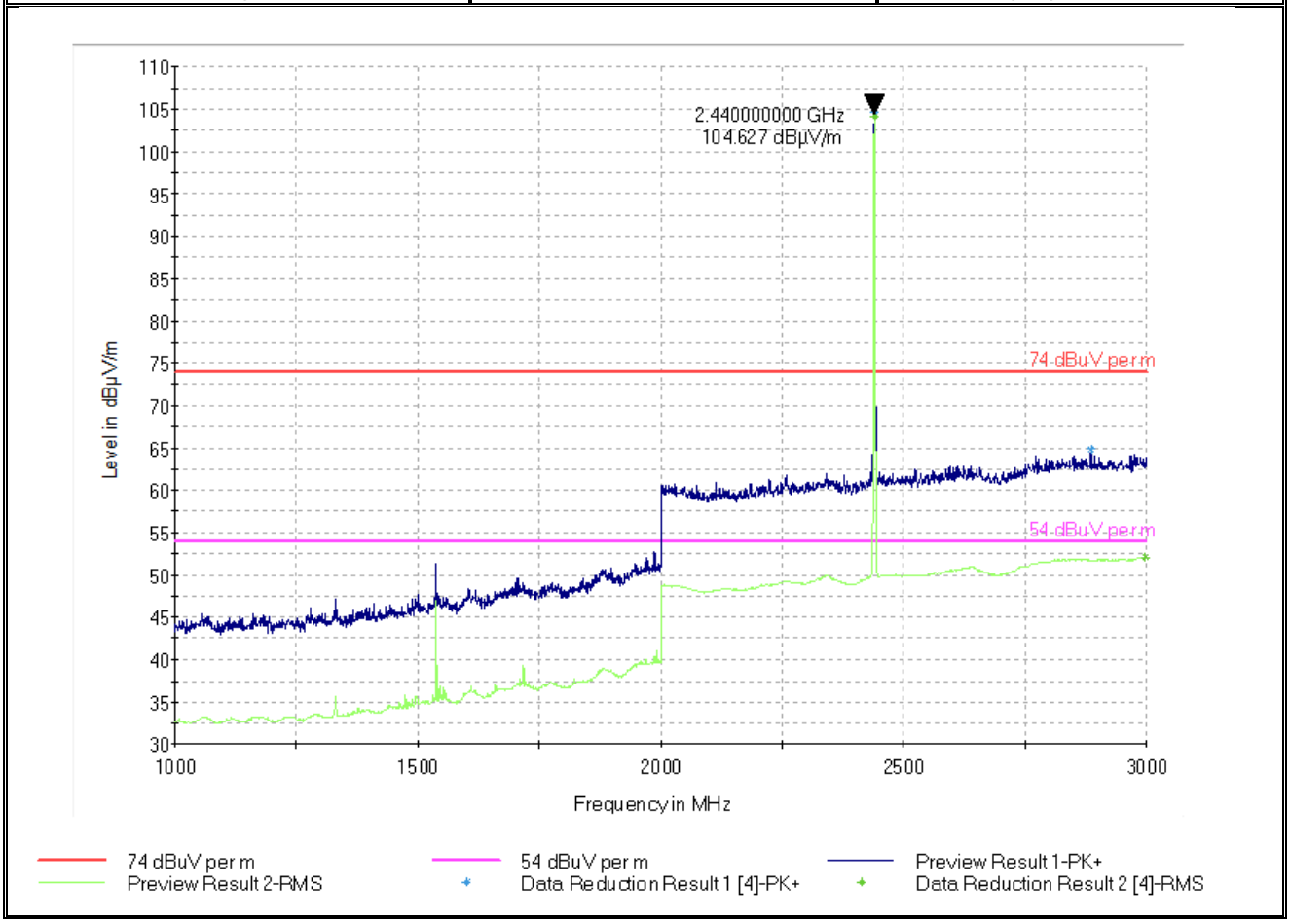
Radiated Emissions: 9 KHz - 30 MHz		
Modulation: π/4-DQPSK	**Channel: 39**	**>98% Duty Cycle**



Radiated Emissions: 30 MHz – 1GHz		
Modulation: π/4-DQPSK	**Channel: 39**	**>98% Duty Cycle**

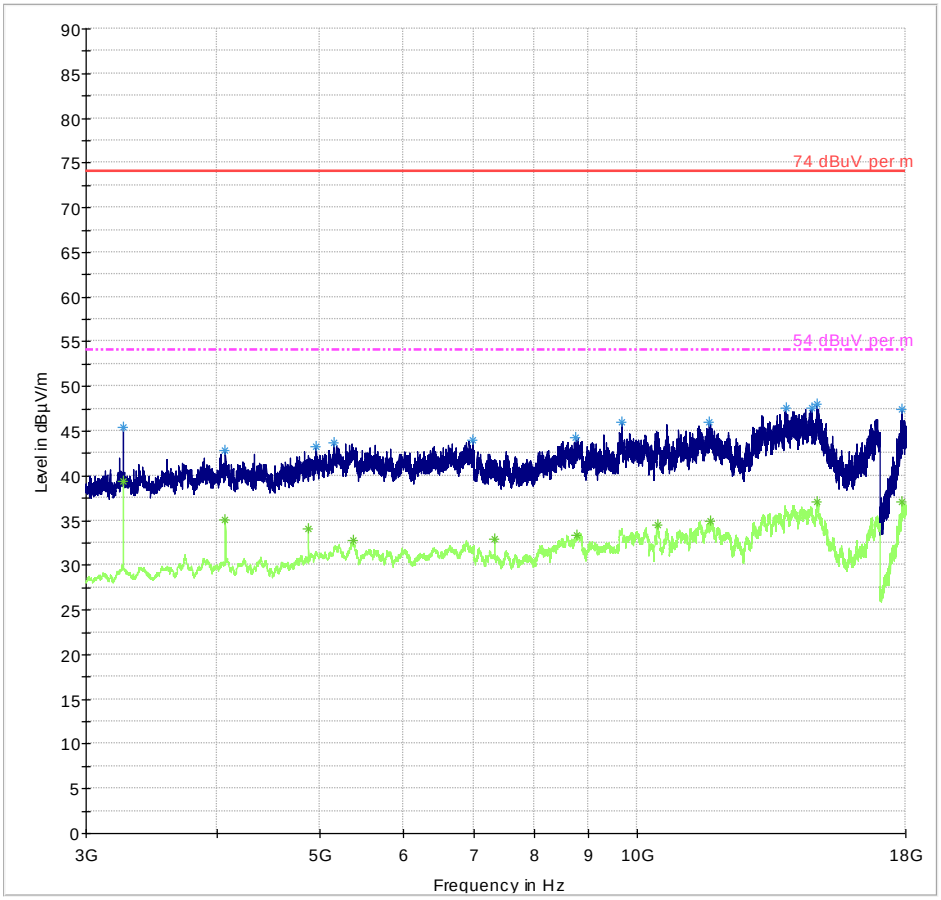


Radiated Emissions: 1-3 GHz		
Modulation: π/4-DQPSK	**Channel: 39**	**>98% Duty Cycle**

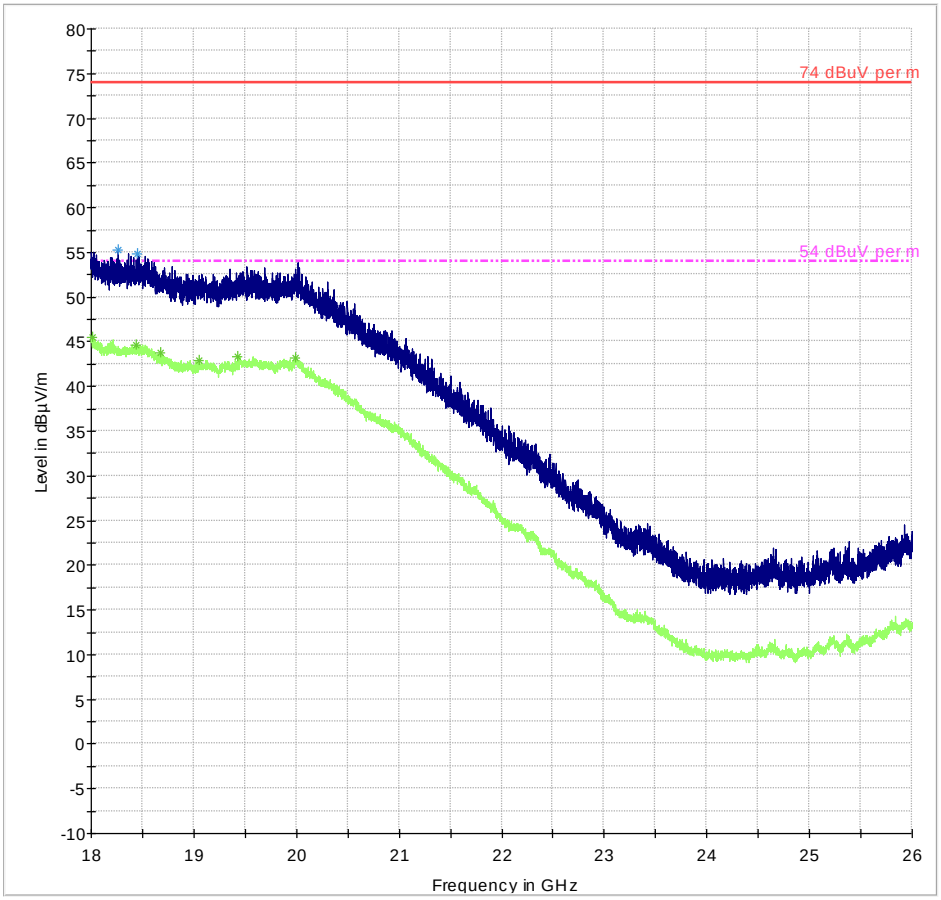


Note: Emission above limit is the Tx Signal

Radiated Emissions: 3-18 GHz		
Modulation: π/4-DQPSK	**Channel: 39**	**>98% Duty Cycle**



Radiated Emissions: 18-26 GHz		
Modulation: π/4-DQPSK	**Channel: 39**	**>98% Duty Cycle**



74 dBuV per m
Preview Result 1-PK+
Data Reduction Result 1 [6]-PK+
54 dBuV per m
Preview Result 2-RMS
Data Reduction Result 2 [6]-RMS

6.3 AC Power Line Conducted Emissions

The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.

6.3.1 Limits:

§15.207 & RSS-Gen 8.8

(a) Except as shown in paragraphs (b) and (c) of this section of the CFR, 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 (1), as measured using a 50 μH/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.

Table 1:

Frequency of emission (MHz)	Conducted limit (dBμV)	
	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.

6.3.2 Test Conditions:

Modulation: GFSK, 8-DPSK and π/4-DQPSK modulation - Transmit modes of operation with >98% Duty Cycle
Tnom: 20°C; Vnom: 120VAC

6.3.3 Test Procedure

Measurement according to
ANSI C63.10 (2013)

Equipment numbers 9, 17 in section 7 of this report were used for this test case.

Analyzer Settings:
RBW = 9 KHz (CISPR Bandwidth)
Detector: Peak / Average for Pre-scan
Quasi-Peak/Average for Final Measurements

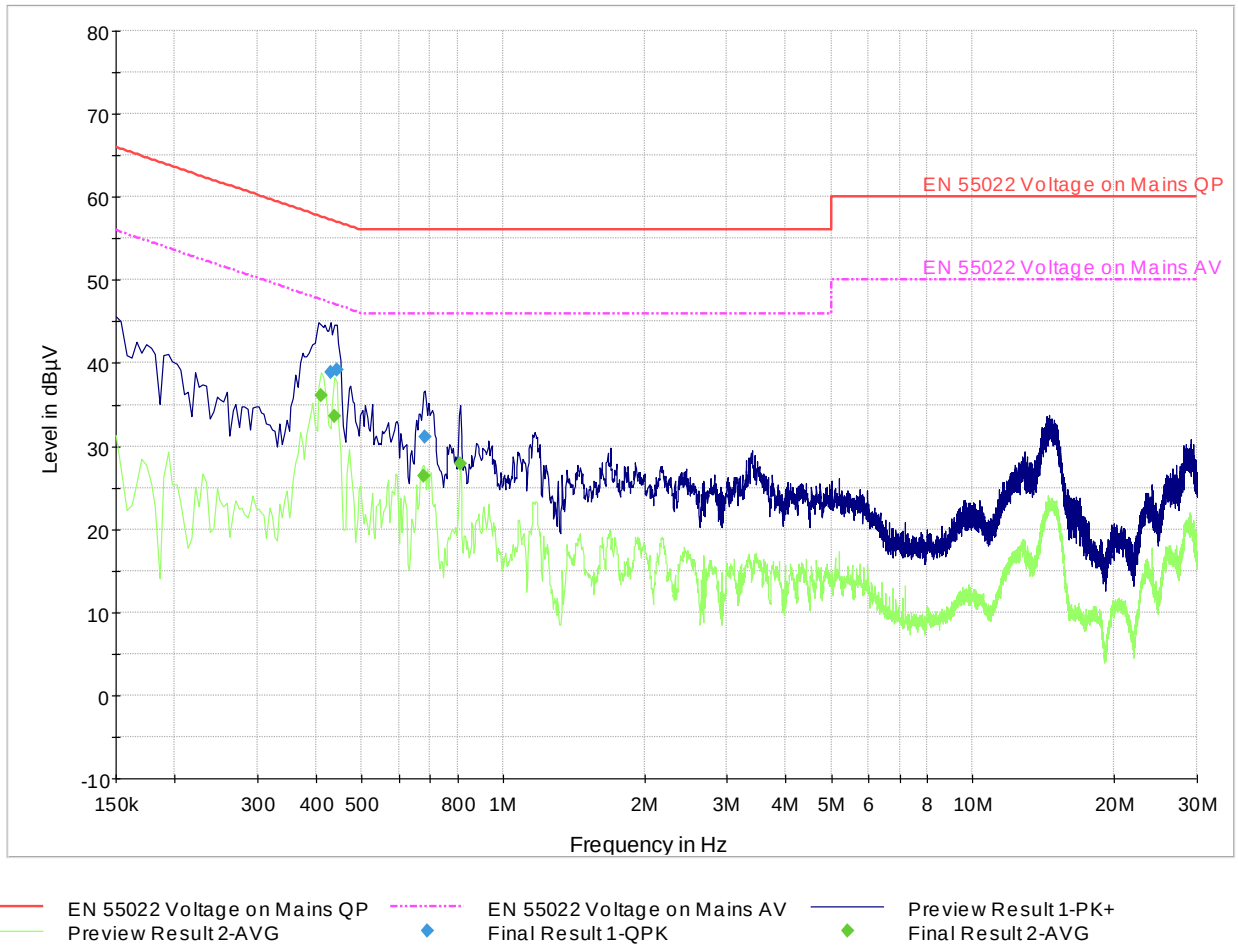
6.3.4 Measurement Result:

Pass. No emissions measured within 6 dB of limit.

6.3.5 Measurement Plots:

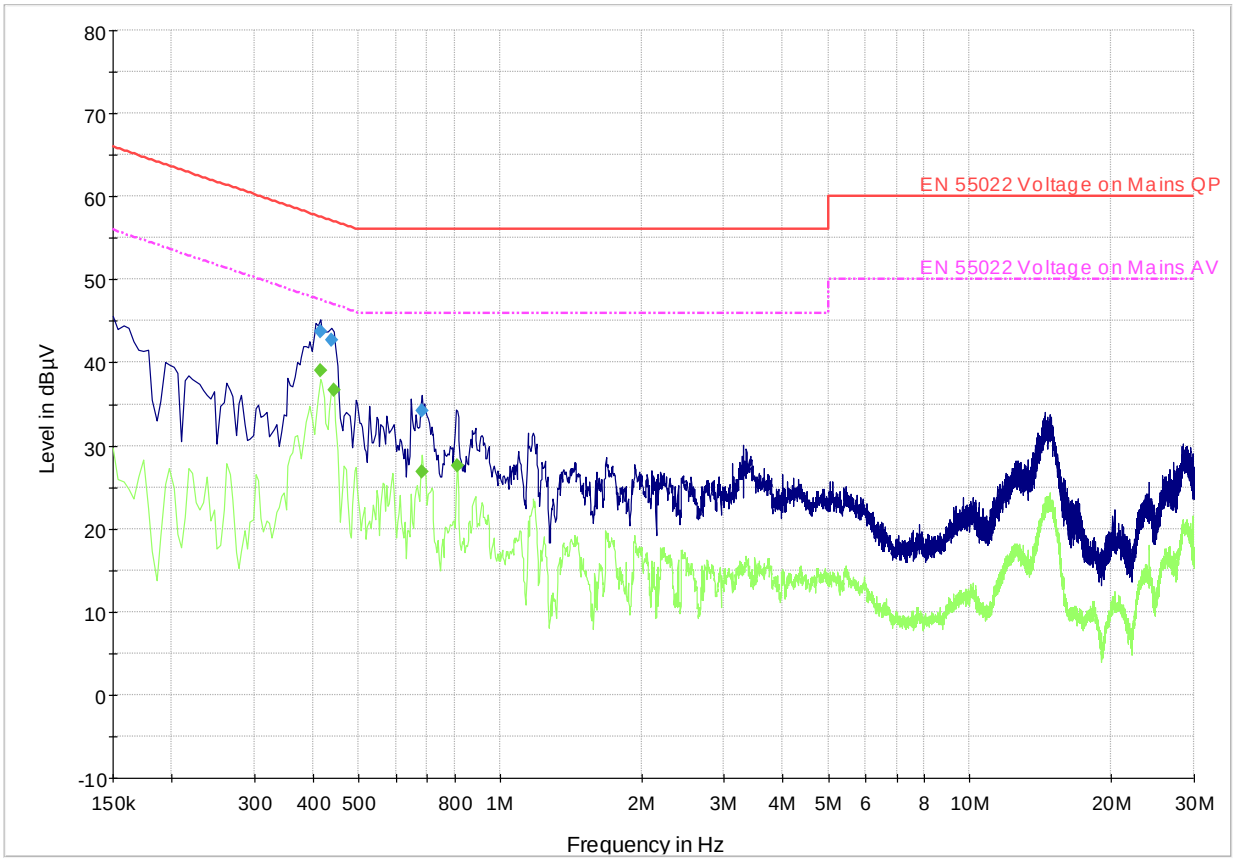
6.3.5.1 Conducted Emissions: 150 KHz – 30 MHz — GFSK modulation

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.430000	38.9	500.0	9.000	GND	N	2.6	18.4	57.3	
0.442000	39.2	500.0	9.000	GND	N	2.5	17.8	57.0	
0.682000	31.1	500.0	9.000	GND	N	1.5	24.9	56.0	



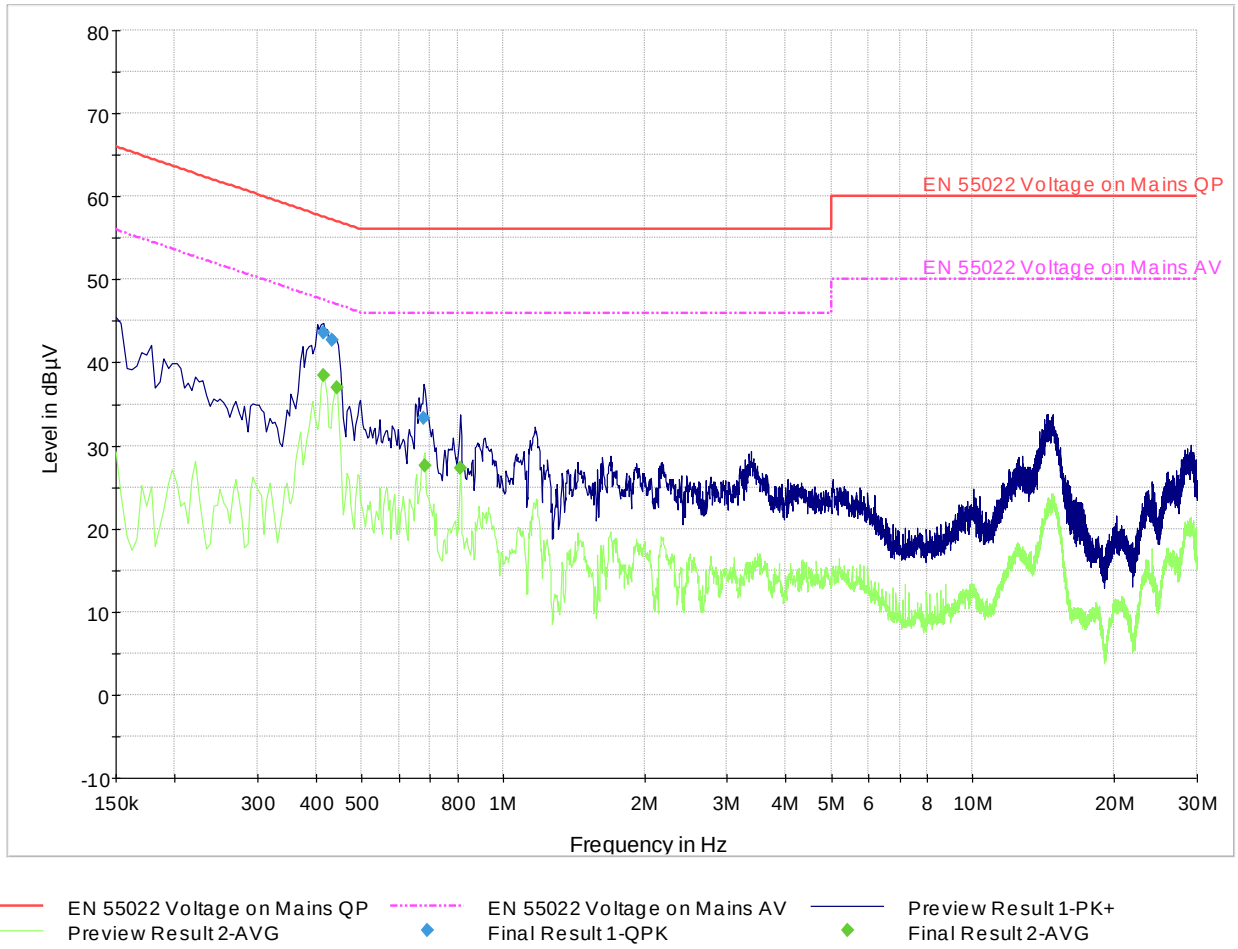
6.3.5.2 Conducted Emissions: 150 KHz – 30 MHz — 8-DPSK modulation

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.414000	43.7	500.0	9.000	GND	N	2.8	13.8	57.6	
0.438000	42.7	500.0	9.000	GND	N	2.5	14.4	57.1	
0.682000	34.2	500.0	9.000	GND	N	1.5	21.8	56.0	



6.3.5.3 Conducted Emissions: 150 KHz – 30 MHz — π/4-DQPSK modulation

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.414000	43.6	500.0	9.000	GND	N	2.8	13.9	57.6	
0.434000	42.7	500.0	9.000	GND	N	2.5	14.4	57.2	
0.678000	33.3	500.0	9.000	GND	N	1.5	22.7	56.0	



7 Test Equipment and Ancillaries used for tests

No.	Equipment Name	Manufacturer	Type/model	Serial No.	Cal Date	Cal Interval
1	Turn table	EMCO	2075	N/A	N/A	N/A
2	MAPS Position Controller	ETS Lindgren	2092	0004-1510	N/A	N/A
3	Antenna Mast	EMCO	2075	N/A	N/A	N/A
4	High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
5	High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
6	6GHz High Pass Filter	HPM50106	Microtronics	001	Part of system calibration	
7	Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
8	Relay Switch Unit	Rohde&Schwarz	RSU	338964/001	N/A	N/A
9	EMI Receiver/Analyzer	Rohde&Schwarz	ESU 40	100251	June 2015	3 Years
10	1500MHz HP Filter	Filtek	HP12/1700	14c48	N/A	N/A
11	2800 MHZ HP Filter	Filtek	HP12/2800	14C47	N/A	N/A
12	Pre-Amplifier	Miteq	JS40010260	340125	N/A	N/A
13	Binconilog Antenna	ETS	3142E	166067	Jun 2014	3 years
14	Horn Antenna	EMCO	3115	35111	Jul 2015	3 Years
15	Horn Antenna	EMCO	3116	00070497	Jul 2015	3 Years
16	Loop Antenna	EMCO	6512	00049838	Mar 2014	3 years
17	LISN	R&S	ESH3-Z5	836679/003	Jun 2013	3 Years
18	Spectrum Analyzer	Rohde&Schwarz	FSU	100189	June 2013	3 Years
19	Spectrum Analyzer	Rohde&Schwarz	FSU-8	200256	Jul 2015	2 Years

Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.
Calibration due dates, unless defined specifically, falls on the last day of the month.
Items indicated “N/A” for cal status either do not specifically require calibration or is internally characterized before use.

8 Revision History

Date	Report Name	Changes to report	Report prepared by
2016-07-27	EMC_HAPIN-001-16501_15.247_FHSS	First Version	Douglas Antioco
2016-08-18	EMC_HAPIN-001-16501_15.247_FHSS_rev1	Replaces previous version. Added Maximum Conducted Output Power Verification (Section 6.1), Updated Sections 3.1, 5.1, 5.2, 5.5, 6.2.3, 6.3.3, and 7.	Douglas Antioco
2016-08-22	EMC_HAPIN-001-16501_15.247_FHSS_rev2	Replaces Previous version. Updated Section 6.1.	Douglas Antioco