FCC/IC Test Report

FOR

Xirgo Technologies

Model Number: XT-4850C

Product Description:
Solar-powered Cellular, GPS, and ZiGBee Tracker

FCC ID: GKM-XT4800
IC ID: 10281A-XT4800

47 CFR Part 15.247 for DSSS Systems

IC RSS-210 Issue 8

TEST REPORT #: EMC_XIRGO-093-15001_DTS
DATE: 2015-05-13

***CETECOM* Inc.**
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1 Assessment

The following equipment (and as identified in Ch.3 of this test report) was evaluated against the applicable criteria specified in FCC CFR47 Part 15.247, 15.207, 15.209 and Industry Canada Standards RSS 210 Issue 8
No deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Xirgo Technologies, Inc.	Solar-powered Cellular, GPS, and ZiGBee Tracker	XT-4850C

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2015-05-13	Compliance	Heiko Strehlow (Chief Operating Officer)	Digitally signed by Heiko Strehlow DN: cn=Heiko Strehlow, o, ou, email, c=US Date: 2015.05.13 16:05:26 -07'00' Signing on Behalf of Franz Engert (Compliance Manager)

Responsible for the Report:

Date	Section	Name	Signature
2015-05-13	Compliance	Douglas Antioco (EMC Engineer)	Douglas Antioco 2015.05.13 14:14:12 -07'00'

The test results of this test report relate exclusively to the test item specified in Section3.
CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	CETECOM Inc. 411 Dixon Landing Rd Milpitas, CA 95035
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:	Xirgo Technologies, Inc
Street Address:	188 Camino Ruiz
City/Zip Code	Camarillo CA 93012
Country	United States
Contact Person:	Nader Barakat
Phone No.	805-233-0583

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as client.
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	XT-4850C
Model Number:	XT-4850C
FCC-ID :	GKM-XT4850C
IC ID:	10281A-XT4850C
Product Description:	Solar-powered Cellular, GPS, and ZiGBee Tracker
Test Mode:	ZigBee IEEE 802.15.4
Frequency Band of Operation:	ISM: 2405-2475MHz
Frequency Range of Test:	2405-2475MHz
No. of Channels:	15
Type(s) of Modulation:	DSSS O-QPSK
Antenna info:	Johanson Technology P/N 2450AT18A100 Internal Ceramic chip antenna Manufacturer stated antenna gain: 2.45 GHz = 0.5dBi peak; -0.5dBi avg
Max. Output Powers:	Conducted: 10.76dBm (see Note) Radiated: 11.26 dBm
Other Radios included:	1. U-blox LISA-C200-24S • (FCC ID: R5Q-LISAC200A / IC ID: 8595B-LISAC200A) • 800/1900 Mhz CDMA 1xRTT 2. GPS 1575.42 MHz
Rated Operating Voltage Range:	Vmin: 9V/ Vnom: 12V/ Vmax: 24V
Rated Operating Temperature Range:	Tmin: -30°C/ Tmax: 70°C
Test Sample Status:	Production

Note: Measurement taken from EMC_Xirgo-080-14001_DTS (CETECOM Inc., 2014-07-10)

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	Sample	HW/SW Version
1	1	Radiated	XT-4850-001/ XT-4850-01

3.3 Identification of ancillary equipment (used for testing purposes only)

AE #	Type	Manufacturer	Model	Serial Number	Comments
1	DC Power Supply	Protek	3003B	H 001416	Power Source

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:

2015/04/01-2015/04/06

3.6 Other Testing Notes:

- The EUT has the same Zigbee chipset and tune up procedure as the previous approved sister model XT-4860G5. The only difference between model XT-4850C and XT-4860G5 is that the XT-4850C has a cellular CDMA module instead of a cellular GSM/WCDMA module. All test results except Transmitter Spurious Emissions has been leveraged from the test report given by Cetecom, Inc dated July 1, 2010 with report number EMC_Xirgo-080-14001_DTS.

- The device was configured for Zigbee operation by a set of commands provided by the manufacturer, capable of setting the unit in different power levels and channels of operation.

- The EUT was tested on low, mid and high channels in **802.15.4 ZigBee** standard**.** Per the client's instructions, the device was set to transmit at its maximum power, so the measurements taken depict the worst case scenario.

4 Subject of Investigation

The objective of the measurements applied by CETECOM Inc. was to establish compliance of the EUT as described under Ch. 3 of this Test Report, with the applicable criteria specified in

- FCC CFR47 Parts 15.247, 15.207, 15.209
- IC RSS-210 Issue 8

This test report is to support a request for new equipment authorization under the FCC ID**: GKM-XT4850C** and IC ID**: 10281A-XT4850C**

5 Summary of Measurement Results

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§15.247(b)(4) RSS210 A8.4(2)	Antenna Gain	Nominal	802.15.4 ZigBee		☐	☐	■	Note 1
§15.247(e) RSS210 A8.2(b)	Power Spectral Density	Nominal	802.15.4 ZigBee		☐	☐	■	Note 1
§15.247(a)(1) RSS210 A8.1(b)	Carrier Frequency Separation	Nominal	802.15.4 ZigBee	☐	☐	■	☐	Note 2
§15.247(a)(1) RSS210 A8.1(d)	Number of Hopping Channels	Nominal	802.15.4 ZigBee	☐	☐	■	☐	Note 2
§15.247(a)(1)(iii) RSS210 A8.3(1)	Time of occupancy	Nominal	802.15.4 ZigBee	☐	☐	■	☐	Note 2
§15.247(a)(1) RSS210 A8.2(a)	Spectrum Bandwidth	Nominal	802.15.4 ZigBee	☐	☐	☐	■	Note 1
§15.247(b)(1) RSS210 A8.4(2)	Maximum Output Power	Nominal	802.15.4 ZigBee	☐	☐	☐	■	Note 1
§15.247(d) RSS210 A8.5	Band edge compliance-Conducted	Nominal	802.15.4 ZigBee	☐	☐	☐	■	Note 1
§15.247(d) RSS210 A8.5	Band edge compliance-Radiated	Nominal	802.15.4 ZigBee	☐	☐	☐	■	Note 1
§15.247(d) RSS210 A8.5	TX Spurious emissions-Conducted	Nominal	802.15.4 ZigBee	☐	☐	☐	■	Note 1
§15.247(d) RSS210 A8.5	TX Spurious emissions-Radiated	Nominal	802.15.4 ZigBee	■	☐	☐	☐	Complies
§15.209(a) RSS Gen	TX Spurious Emissions Radiated<30MHz	Nominal	802.15.4 ZigBee	☐	☐	☐	■	Note 1
§15.107(a)	Conducted Emissions <30MHz	Nominal	802.15.4 ZigBee	☐	☐	☐	■	Note 1

NA= Not Applicable; NP= Not Performed.

Note 1: Leveraged from EMC_Xirgo-080-14001_DTS (CETECOM Inc., 2014-07-10)
Note 2: Test only applicable to frequency hopping systems.

6 Measurements

6.1 Radiated Measurement Procedure

6.2 Measurement Method:

All radiated and conducted testing is performed according to guidelines in FCC publication KDB558074 D01Meas Guidance v03r02: Measurement Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) operating under 15.247, June 2014.

6.3 Radiated Measurement Procedure

ANSI C63.4 (2009) Section 8.3.1.1: Exploratory radiated emission measurements
Exploratory radiated measurements shall be performed at the measurement distance or at a closer distance than that specified for compliance to determine the emission characteristics of the EUT. At near distances, for EUTs of comparably small size, it is relatively easy to determine the spectrum signature of the EUT and, if applicable, the EUT configuration that produces the maximum level of emissions. A shielded room may be used for exploratory testing, but may have anomalies that can lead to significant errors in amplitude measurements.
Broadband antennas and a spectrum analyzer or a radio-noise meter with a panoramic display are often useful in this type of testing. It is recommended that either a headset or loudspeaker be connected as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT when the exploratory and final testing is performed in an OATS with strong ambient signals. Caution should be taken if either antenna height between 1 and 4 meters or EUT azimuth is not fully explored. Not fully exploring these parameters during exploratory testing may require complete testing at the OATS or semi-anechoic chamber when the final full spectrum testing is conducted.
The EUT should be set up in its typical configuration and arrangement, and operated in its various modes. For tabletop systems, cables or wires should be manipulated within the range of likely arrangements. For floor-standing equipment, the cables or wires should be located in the same manner as the user would install them and no further manipulation is made. For combination EUTs, the tabletop and floor-standing portions of the EUT shall follow the procedures for their respective setups and cable manipulation. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to produce the maximum level of emissions.
For each mode of operation required to be tested, the frequency spectrum shall be monitored. Variations in antenna height between 1 and 4 m, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) shall be explored to produce the emission that has the highest amplitude relative to the limit. A step-by-step technique for determining this emission can be found in Annex C.
When measuring emissions above 1 GHz, the frequencies of maximum emission shall be determined by manually positioning the antenna close to the EUT and by moving the antenna over all sides of the EUT while observing a spectral display. It will be advantageous to have prior knowledge of the frequencies of emissions above 1 GHz. If the EUT is a device with dimensions approximately equal to that of the measurement antenna beam width, the measurement antenna shall be aligned with the EUT.

ANSI C63.4 (2009) Section 8.3.1.2: Final radiated emission measurements

Based on the measurement results in 8.3.1.1, the one EUT, cable and wire arrangement, and mode of operation that produces the emission that has the highest amplitude relative to the limit is selected for the final measurement. The final measurement is then performed on a site meeting the requirements of 5.3, 5.4, or 5.5 as appropriate without variation of the EUT arrangement or EUT mode of operation. If the EUT is relocated from an exploratory test site to a final test site, the highest emission shall be re-maximized at the final test location before final radiated emissions measurements are performed. However, antenna height and polarity and EUT azimuth are to be varied. In addition, the full frequency spectrum (for the range to be checked for meeting compliance) shall be investigated.

This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. During the full frequency spectrum investigation, particular focus should be made on those frequencies found in exploratory testing that were used to find the final test configuration, mode of operation, and arrangement (associated with achieving the least margin with respect to the limit). This full spectrum test constitutes the compliance measurement.

For measurements above 1 GHz, use the cable, EUT arrangement, and mode of operation determined in the exploratory testing to produce the emission that has the highest amplitude relative to the limit. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the antenna in the "cone of radiation" from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response. The antenna may have to be higher or lower than the EUT, depending on the EUT's size and mounting height, but the antenna should be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. If the transmission line for the measurement antenna restricts its range of height and polarization, the steps needed to ensure the correct measurement of the maximum emissions, shall be described in detail in the report of measurements. Data collected shall satisfy the report requirements of Clause 10.

NOTES
1— Where limits are specified by agencies for both average and peak (or quasi-peak) detection, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.
2—Use of waveguide and flexible waveguide may be necessary at frequencies above 10 GHz to achieve usable signal-to noise ratios at required measurement distances. If so, it may be necessary to restrict the height search of the antenna, and special care should be taken to ensure that maximum emissions are correctly measured.
3—All presently known devices causing emissions above 10 GHz are physically small compared with the beam-widths of typical horn antennas used for EMC measurements. For such EUTs and frequencies, it may be preferable to vary the height and polarization of the EUT instead of the receiving antenna to maximize the measured emissions.

Measurement Uncertainty: ±3dB

6.4 Sample Calculations for Radiated Measurements

6.4.1.1 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.

6.5 Transmitter Spurious Emissions- Radiated

6.5.1 Limits:

§15.247/15.205
RSS-210 A8.5

Frequency of emission (MHz)	Field strength (µV/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

Frequency of emission (MHz)	Field strength (µV/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)

6.5.2 Test Conditions:

Tnom: 20°C; Vnom: 12 VDC

6.5.3 Measurement Verdict

Pass.

6.5.4 Test Result:

Plots reported here represent the worst case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT.

Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmit signal.

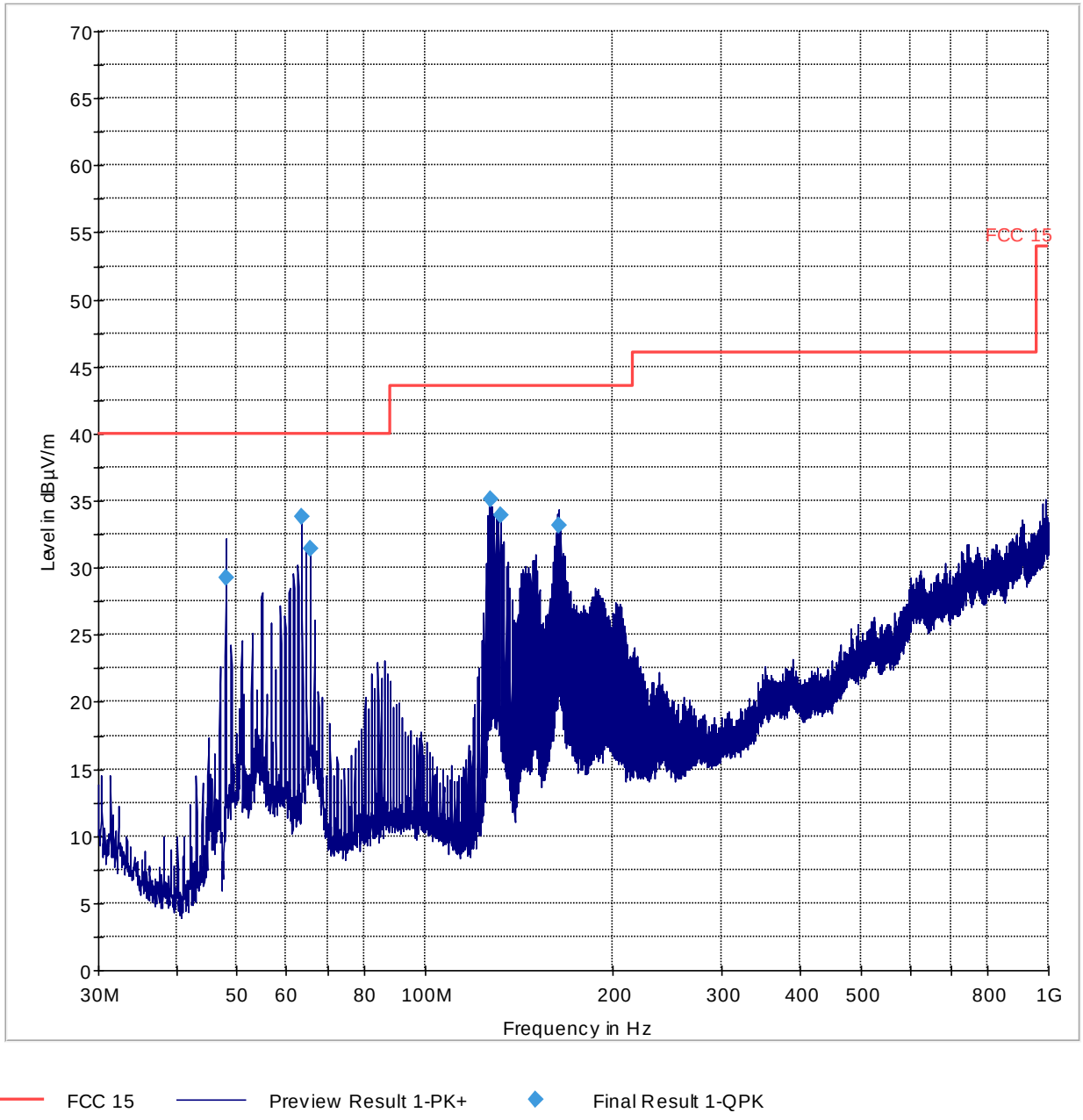
Second harmonic is visible for low, mid and high channel with levels below 47.5dBuV/m Average and 6.5dB margin to the limit.

Measurement Uncertainty: ±3.0dB

6.5.5 Test data/ plots:

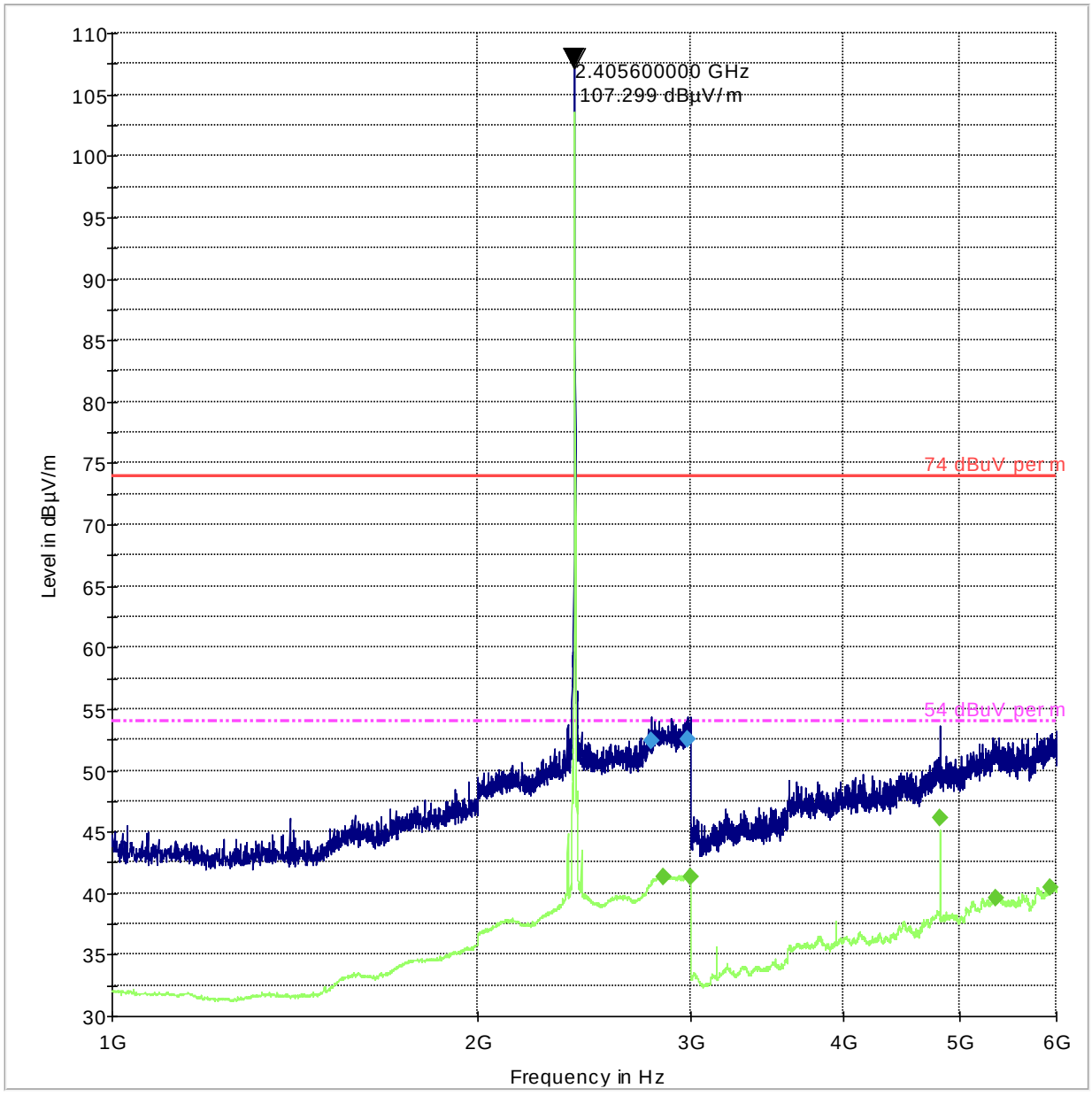
6.5.5.1 RSE - Ch11 (2405 MHz): 30M-1GHz

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

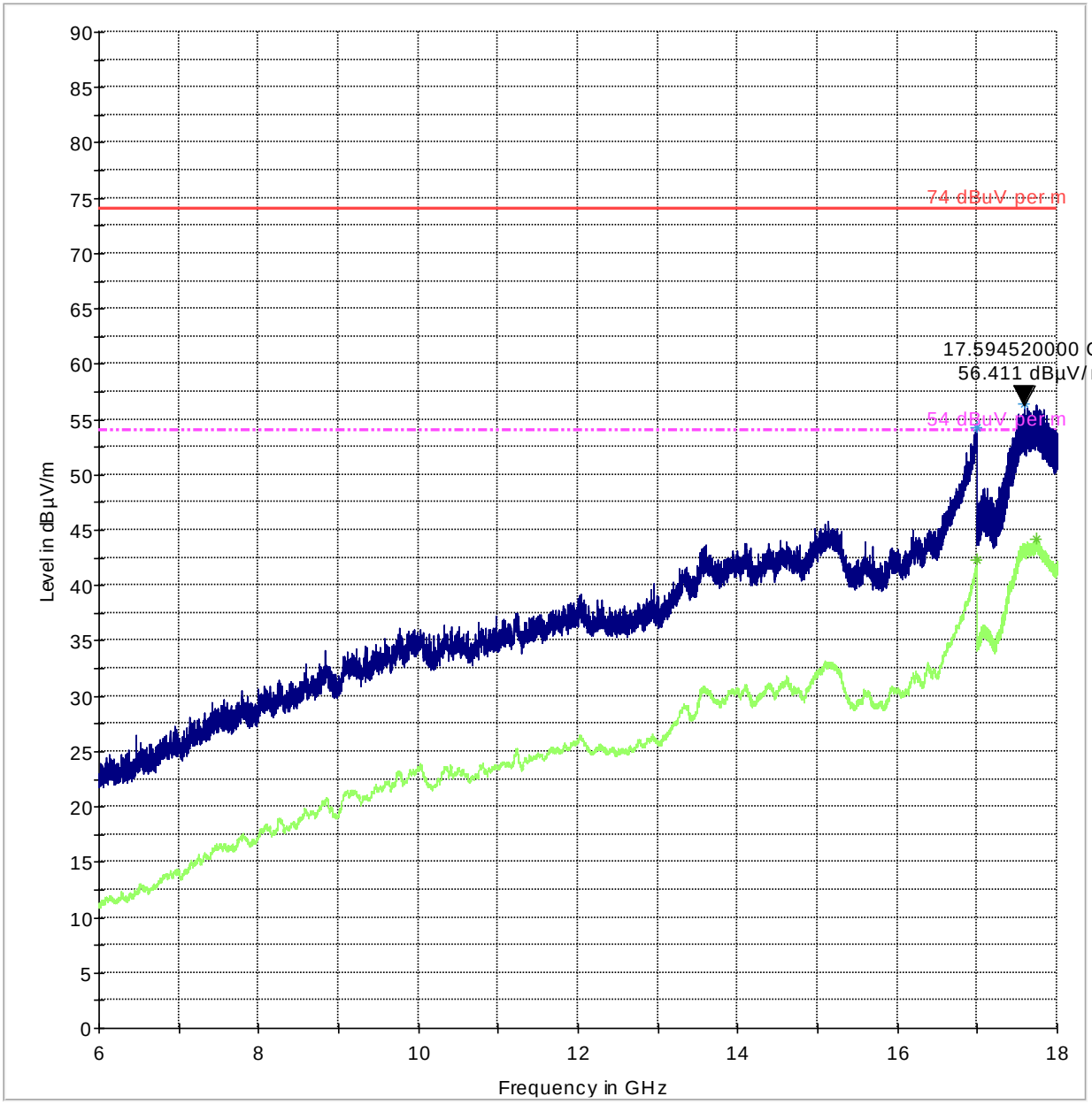


6.5.5.2 RSE - Ch11 (2405 MHz): 1G-6GHz

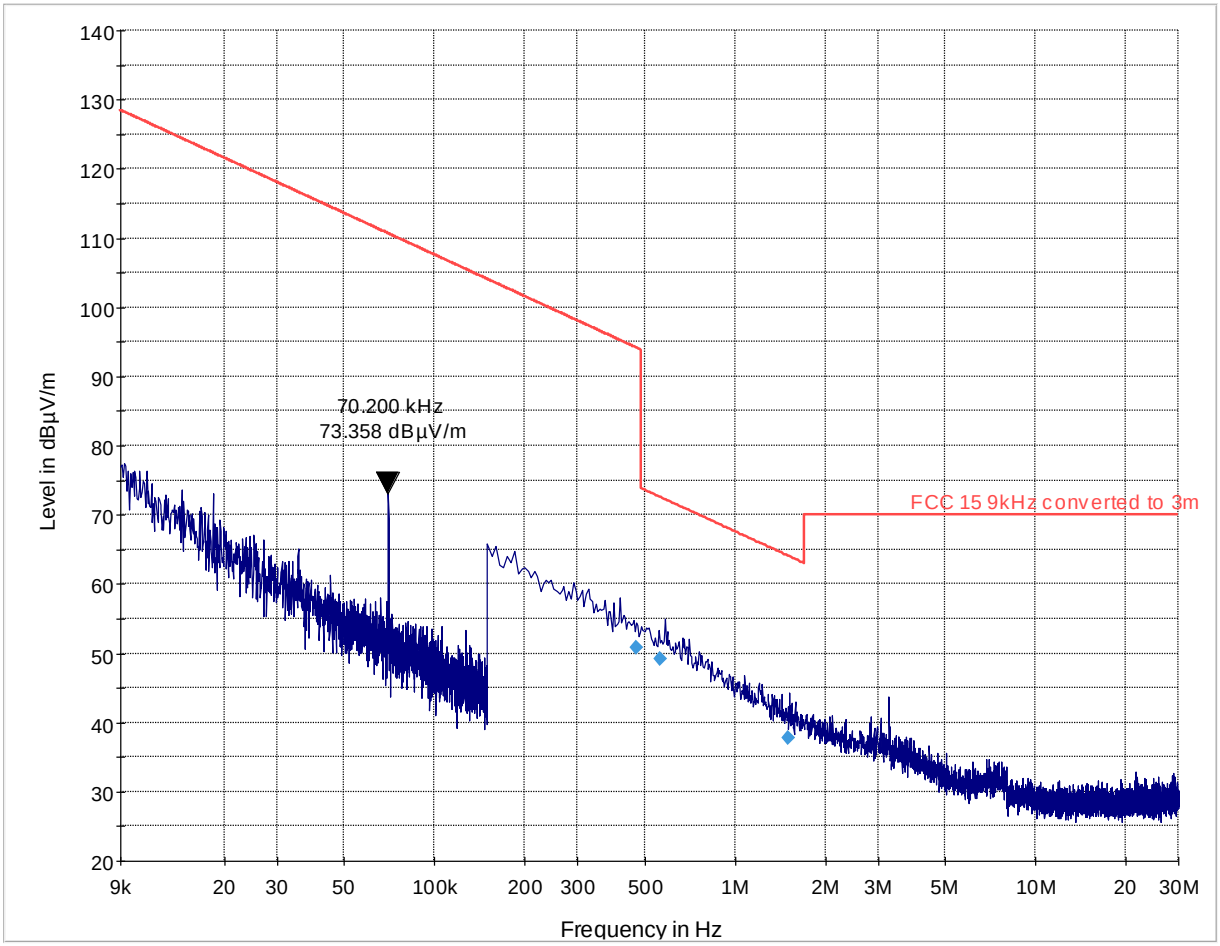
Emission above the limit line from the transmitter.



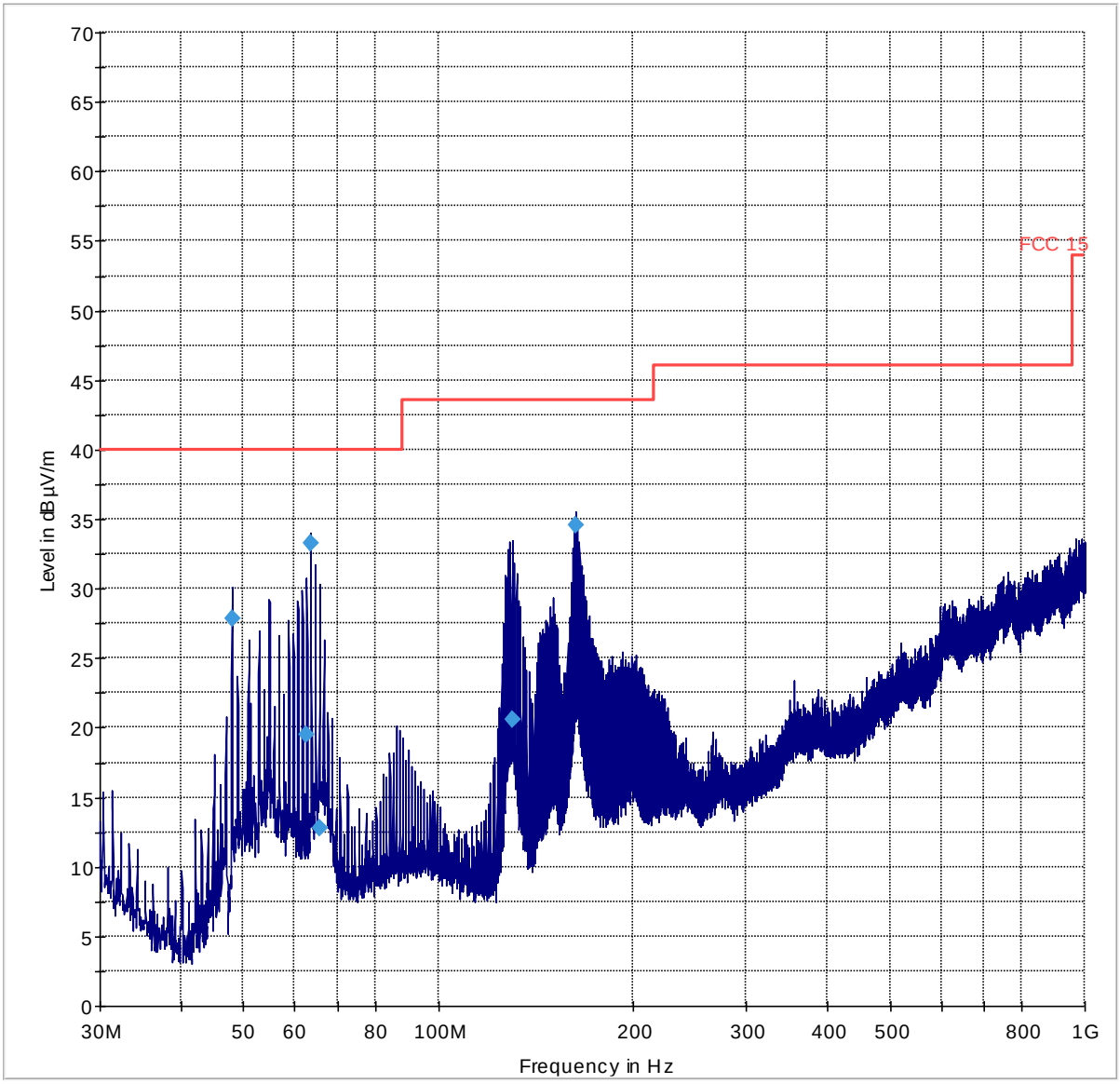
6.5.5.3 RSE - Ch11 (2405 MHz): 6-18GHz



6.5.5.4 RSE - Ch18 (2440 MHz): <30MHz

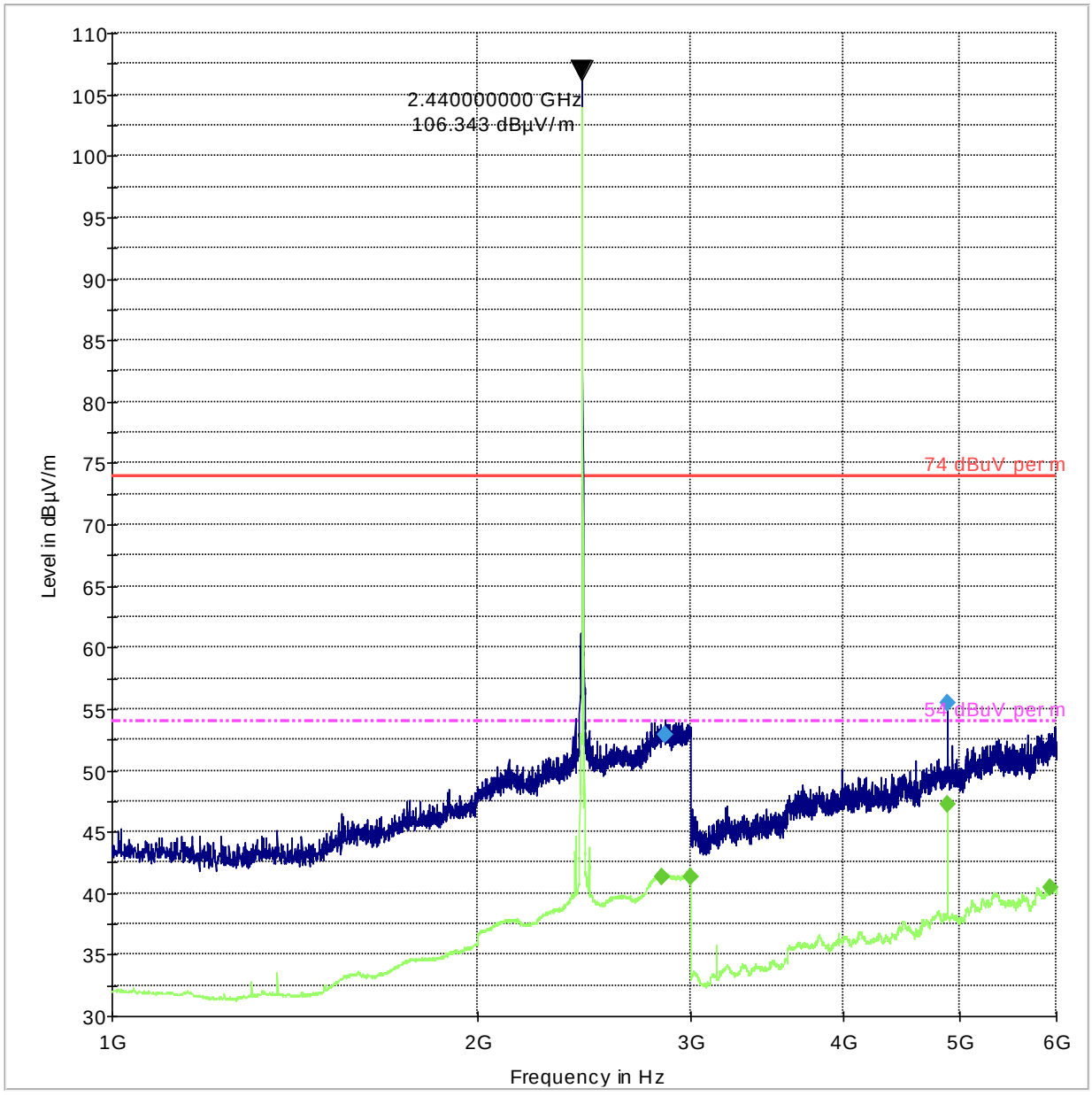


6.5.5.5 RSE - Ch18 (2440 MHz): 30M-1GHz

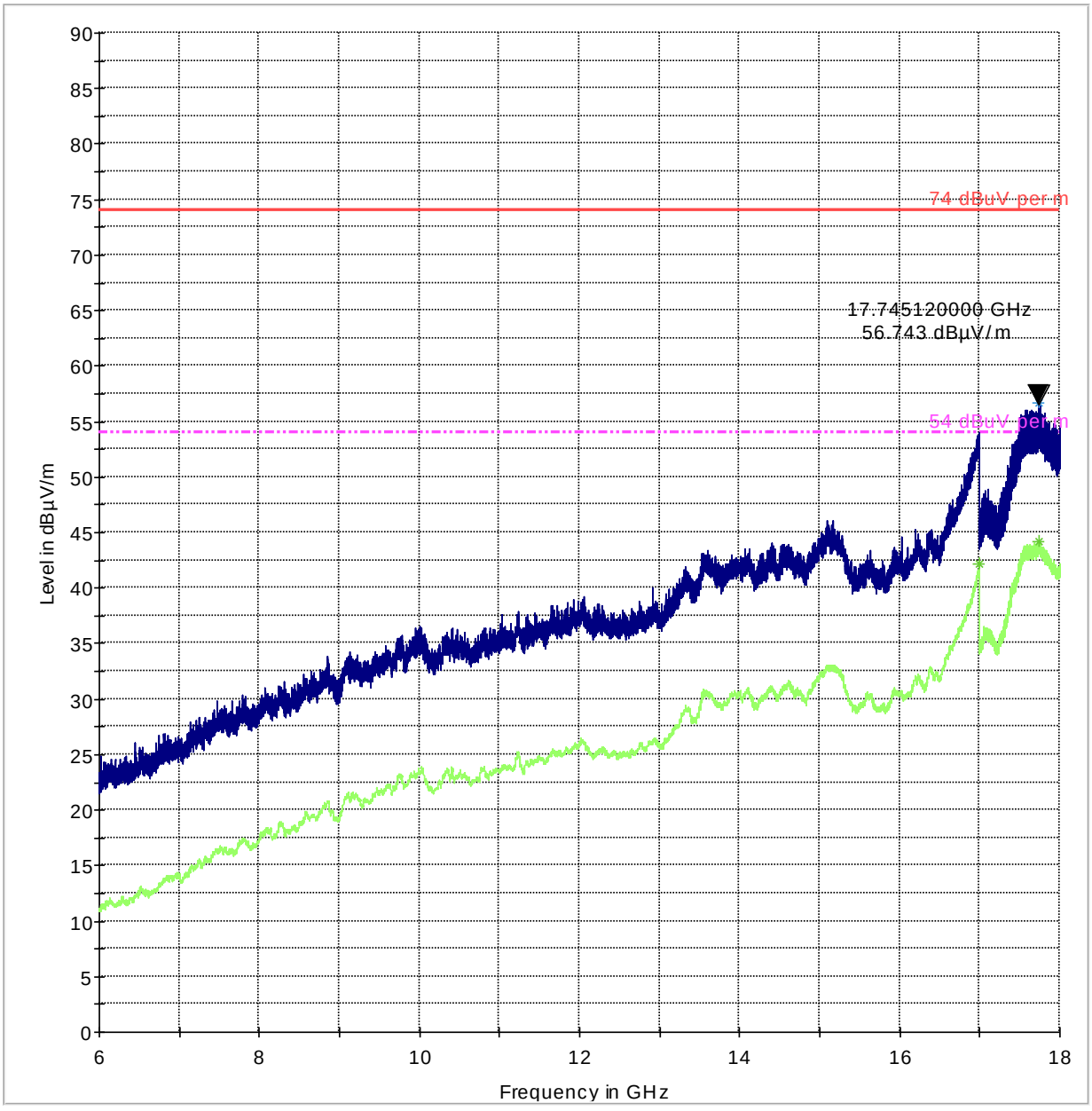


6.5.5.6 RSE - Ch18(2440 MHz): 1G-6GHz

Emission above the limit line from the transmitter.

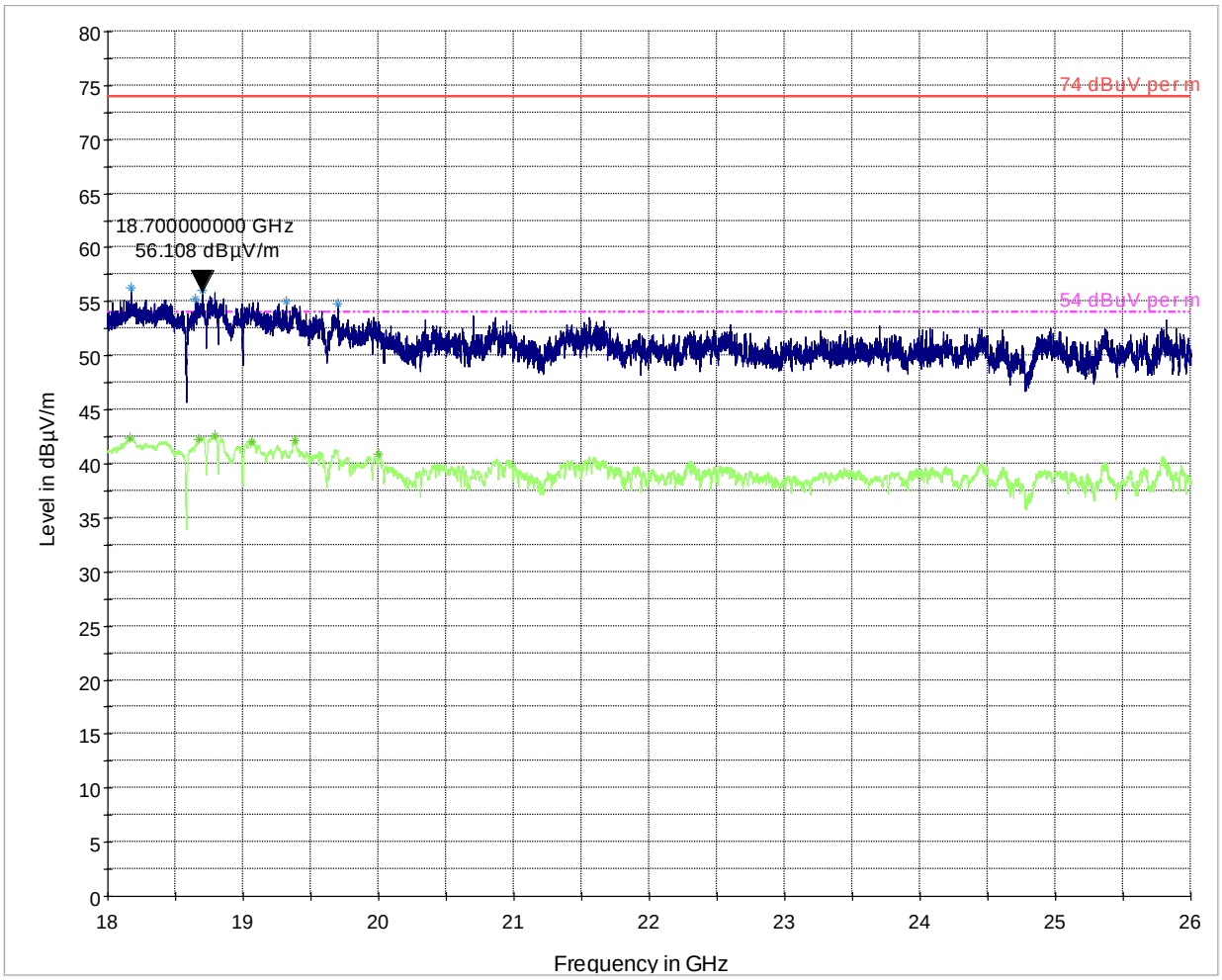


6.5.5.7 RSE - Ch18 (2440 MHz): 6-18GHz

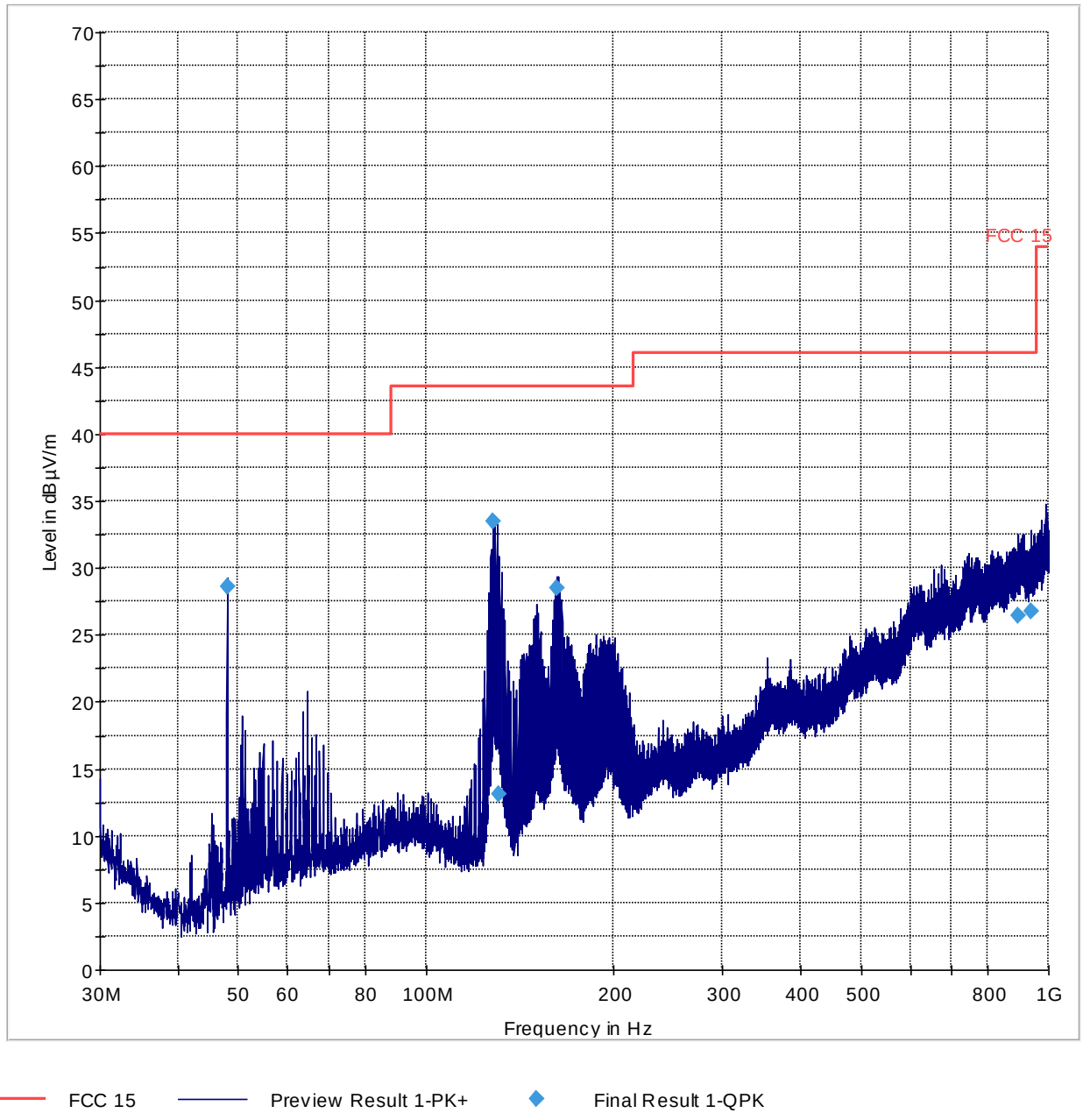


6.5.5.8 RSE - Ch18 (2440 MHz): 18G-26GHz

Note: Worst case representation of all channels

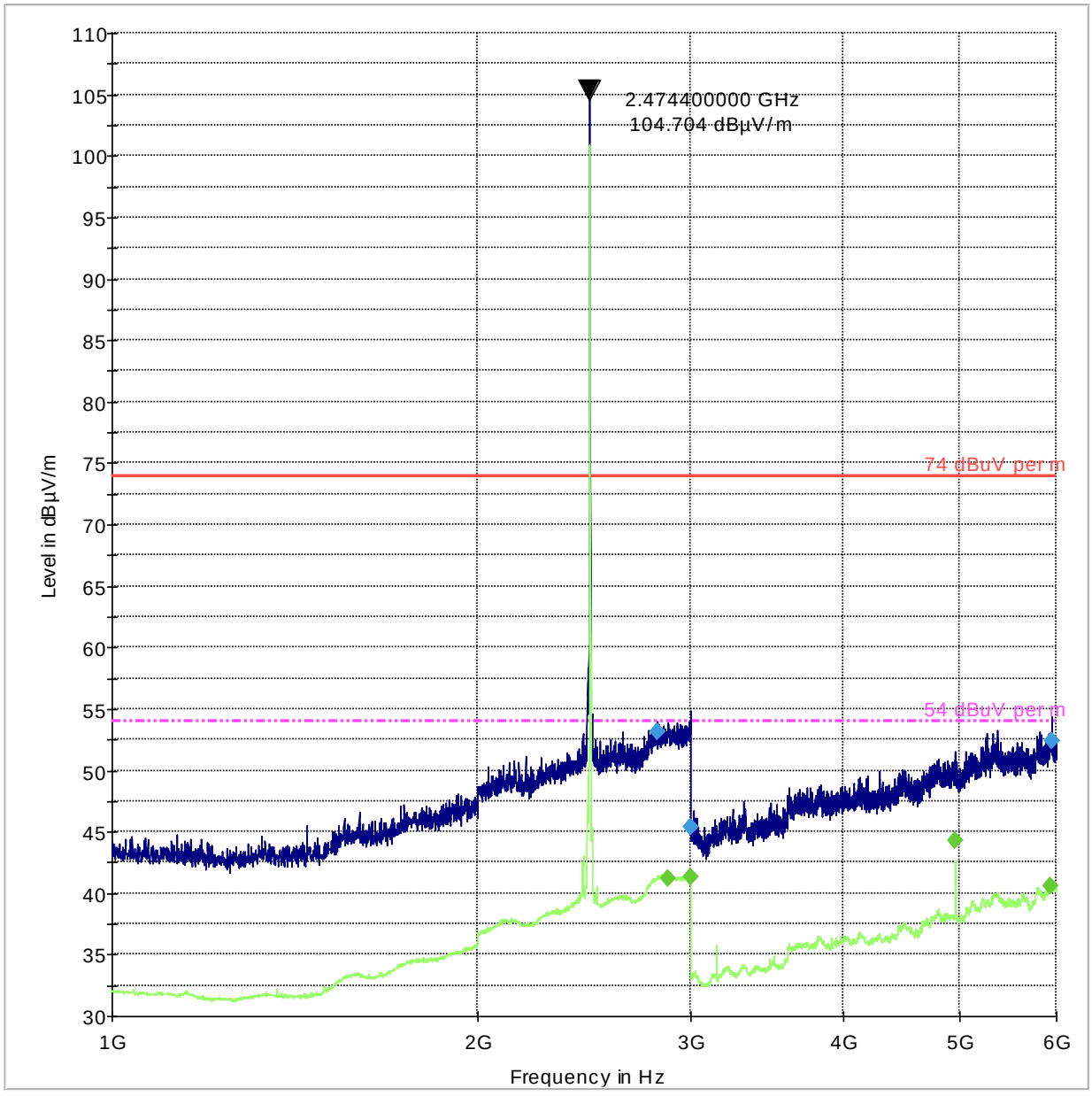


6.5.5.9 RSE - Ch25 (2475 MHz): 30M-1GHz

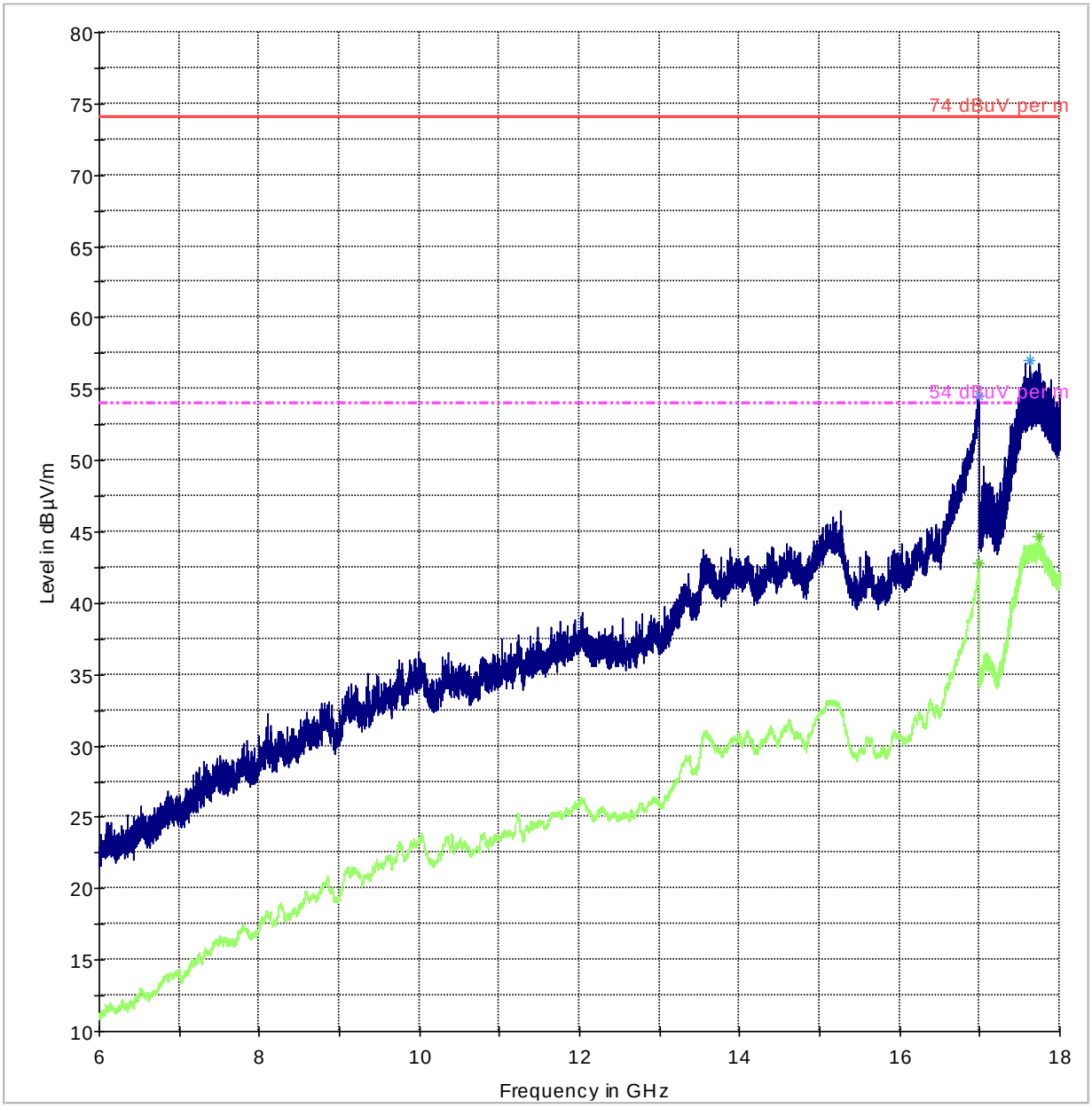


6.5.5.10 RSE - Ch25 (2475 MHz): 1G-6GHz

Emission above the limit line from the transmitter.



6.5.5.11 RSE - Ch25 (2475 MHz): 6-18GHz



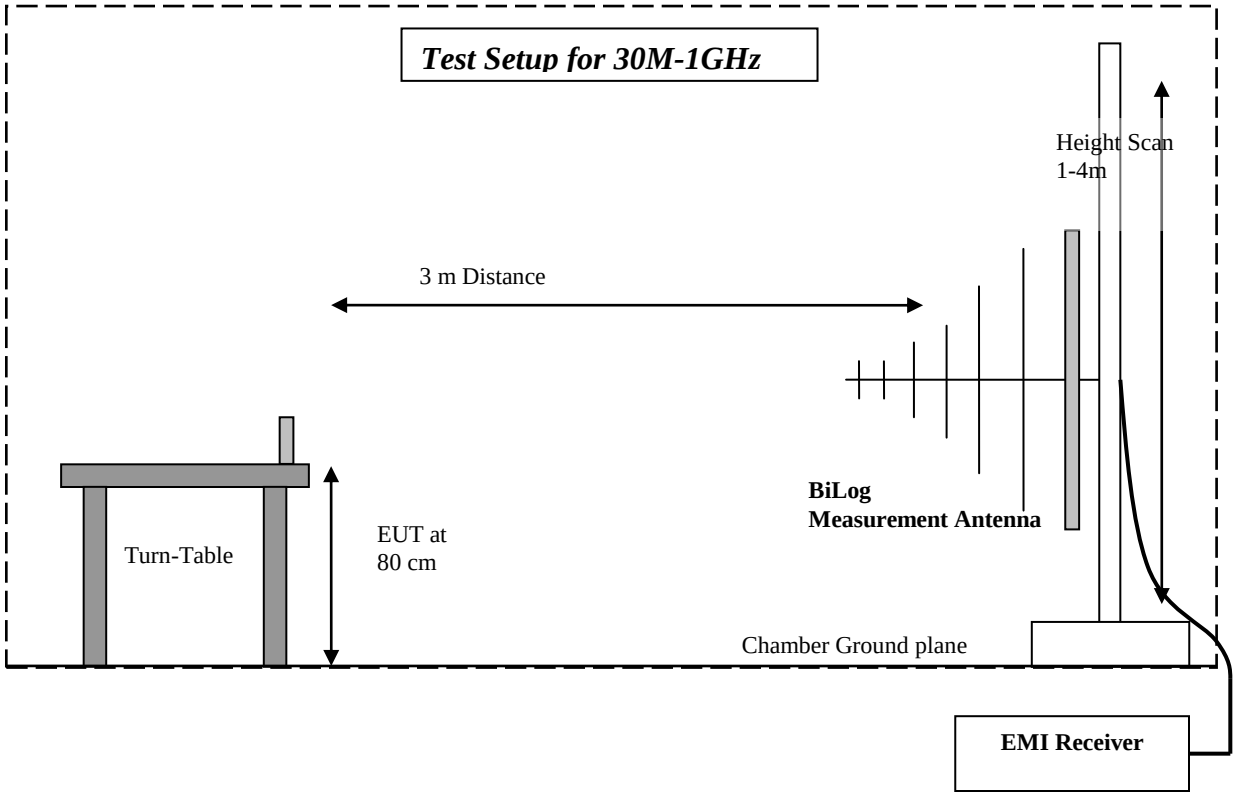
74 dBuV per m
Preview Result 1-PK+
Data Reduction Result 1 [5]-PK+
54 dBuV per m
Preview Result 2-AVG
Data Reduction Result 2 [5]-AVG

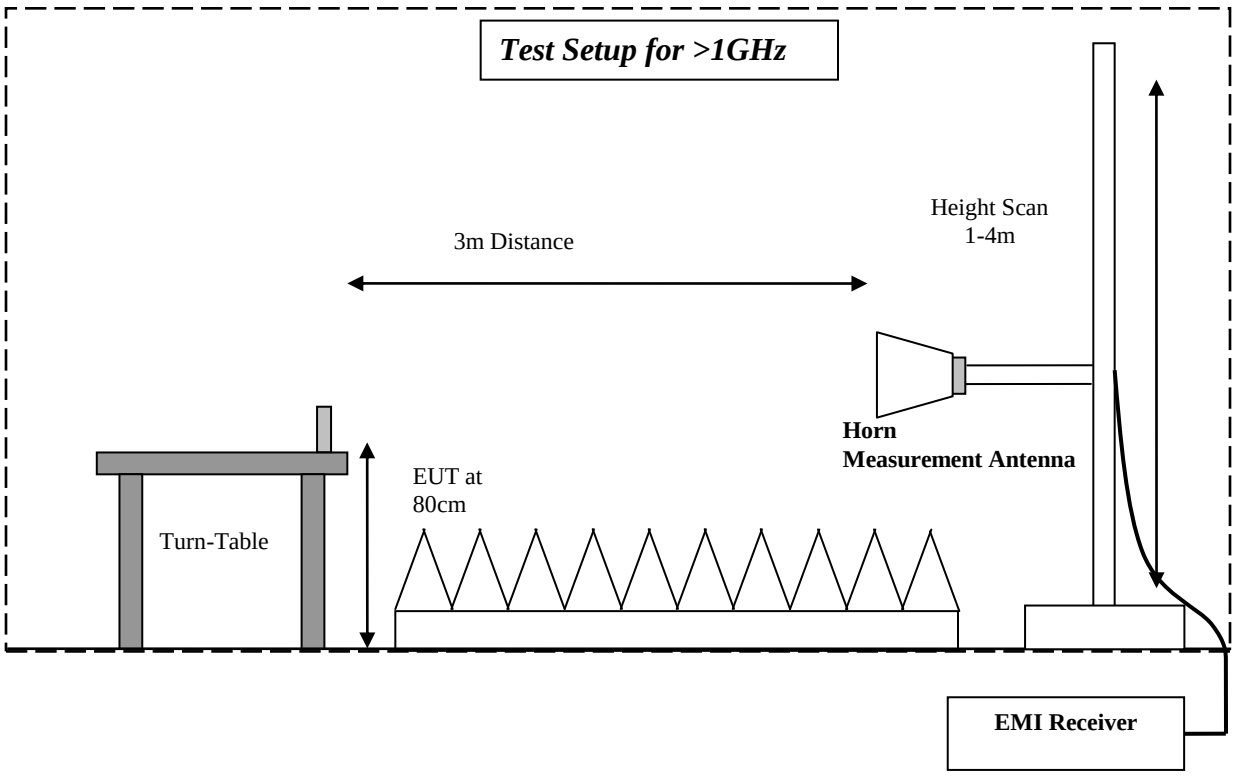
7 Test Equipment and Ancillaries used for tests

No.	Equipment Name	Manufacturer	Type/model	Serial No.	Cal Date	Cal Interval
3m Semi- Anechoic Chamber:						
	Digital Radio Comm. Tester	Rohde&Schwarz	CMU 200	101821	Jun 2013	2 Years
	EMC32 Measurement Software	Rohde&Schwarz	8.52.0	N/A	N/A	N/A
	Turn table	EMCO	2075	N/A	N/A	N/A
	MAPS Position Controller	ETS Lindgren	2092	0004-1510	N/A	N/A
	Antenna Mast	EMCO	2075	N/A	N/A	N/A
	Relay Switch Unit	Rohde&Schwarz	RSU	338964/001	N/A	N/A
	EMI Receiver/Analyzer	Rohde&Schwarz	ESU 40	100251	Sep 2013	2 Years
	1500MHz HP Filter	Filtek	HP12/1700	14c48	N/A	N/A
	2800 MHz HP Filter	Filtek	HP12/2800	14C47	N/A	N/A
	Pre-Amplifier	Miteq	JS40010260	340125	N/A	N/A
	Binconilog Antenna	EMCO	3141	0005-1186	Apr 2012	3 Years
	Horn Antenna	EMCO	3115	35114	Mar 2012	4 Years
	Horn Antenna	ETS Lindgren	3116	70497	Mar 2012	4 Years
	Spectrum Analyzer	Rohde&Schwarz	FSU	100189	Jun 2013	2 Years
	Loop Antenna 6512	ETS Lindgren	6512	49838	Mar 2014	3 Years
Ancillary equipment						
	Humidity Temperature Logger	Dickson	TM320	0928016	Jul 2014	1 Year
	Communication Antenna	IBP5-900/1940	Kathrein	N/A	N/A	N/A

Calibration status valid at the time of testing.
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 Test Setup Diagrams:




Test Setup for >1GHz
Height Scan
1-4m
3m Distance
Horn
Measurement Antenna
EUT at
80cm
Turn-Table
EMI Receiver

9 Revision History

Date	Report Name	Changes to report	Report prepared by
2015-05-13	EMC_XIRGO-093-15001_DTS	First Version	Douglas Antioco