FCC Test Report

FOR

Marquardt GmbH

MODEL #: WIN Gen 2
Integrated Vehicular Receiver

FCC ID: IYZ-C01D
IC ID: 2701A-C01D

FCC- Part 15.209 and FCC- Part 15.109 (15B)

RSS 210 and RSS-Gen

TEST REPORT #: EMC_MARQU_004_12001_WIN_Rev1
DATE: 2012-06-20

FCC listed:
A2LA Accredited

IC recognized #
3462B-1

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

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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 Parts 15.209, 15.109, 15.35 (c)**
- **Industry Canada Radio Standard Specifications RSS-210 Issue 8, RSS-Gen Issue 3**

and no deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Marquardt GmbH	**Integrated Vehicular Receiver**	**WIN Gen 2**

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2012-06-20	Compliance	Sajay Jose (Lab Manager)	Sajay Jose 2012.06.20 16:07:13 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
2012-06-20	Compliance	Tunji Yusuf (EMC Engineer)	

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
Test Lab Manager:	Sajay Jose
Responsible Project Leader:	David Ahn
Test Engineer:	Tunji Yusuf

2.2 Identification of the Applicant

Applicant's name:	Marquardt GmbH
Street Address:	Schloss - Str. 16
City/Zip Code	Rietheim – Weilheim, 78604
Country	Germany
Contact Person:	Thomas Schwarz
Title:	Director of Central Development
Phone No.	74 24-99 16 43
e-mail:	Thomas.Schwarz@marquardt.de

2.3 Identification of the Client

Client:	Marquardt Switches Inc.
Street Address:	2917 Waterview Drive
City/Zip Code	Rochester Hills, Michigan 48309
Country	U.S.A
Contact Person:	Djordje Preradovic
Phone No.	248-377-3100
e-mail:	djordjegeorge.preradovic@Marqswitch.com

2.4 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:	WIN Gen 2 (WIN stands for Wireless Ignition Node)
Model No:	WIN Gen 2
FCC-ID:	IYZ-C01D
IC-ID :	2701A-C01D
Transceiver information:	LF Transceiver 125 KHz RF Receiver 433.92 MHz
Type(s) of Modulation:	LF Transceiver: ASK RF Receiver: ASK and FSK
Number of Channels:	1
Antenna Type:	Transceiver: Wound coil Receiver: Passive Antenna.
EUT Condition:	Production

3.2 Identification of the Equipment under Test (EUT)

EUT #	Serial Number	Model	Manufacturer
1	"Labeled" EUT1	WIN Gen2	Marquardt Switches Inc.

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 against the applicable criteria specified in

- FCC CFR47 Parts 15.209, 15.109, 15.35 (c)
- Industry Canada Radio Standard Specifications RSS-210 Issue 8, RSS-Gen Issue 3

The relevant procedures of ANSI C63.4: 2009 have been followed.
All radiated test data in this report shows the worst case emissions for H/V measurement antenna polarizations and for all three orthogonal orientations of the EUT.

5 Measurements

5.1 Radiated Emissions

5.1.1 FCC Part 15.209 Radiated emission limits, general requirements.

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

5.1.2 Section 15.109 Radiated emission limits, general requirements/ RSS-Gen Section 6

The emissions from an unintentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

5.1.3 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 beamwidth, 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 remaximized 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.

5.1.4 Sample Calculations for Radiated Measurements

5.1.4.1 Field Strength Measurements:

Measurements from the Spectrum Analyzer/ Receiver is 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.

5.1.5 Results :

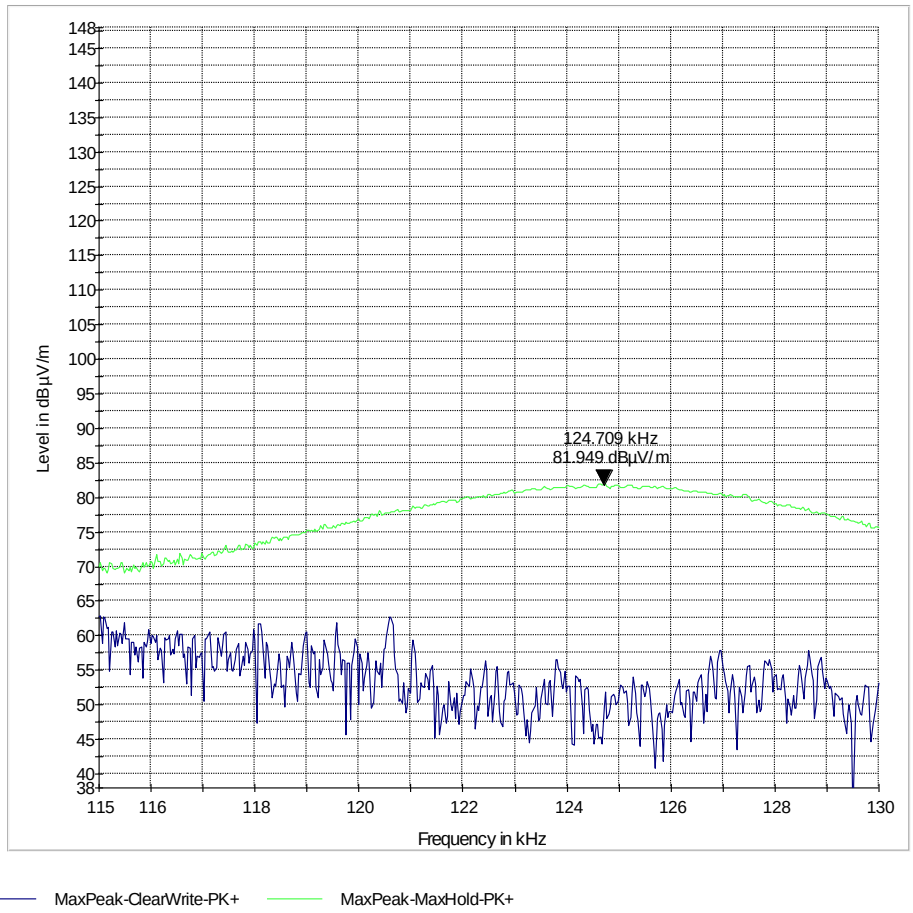
5.1.5.1 Limit:
FCC 15.209 states that the field strength limits for the fundamental in the frequency range 0.009 - 0.490 MHz = 2400/F (kHz) for a given test distance of 300 meters.

Fundamental Field Strength Limit @300m
= 2400/125 kHz = **19.2µV/m**
= 20 * log (19.2) = **25.67 dBµV/m**

5.1.5.2 Test Result:
Measurements were performed at 3m distance using a loop antenna at a height of 1m from the ground.

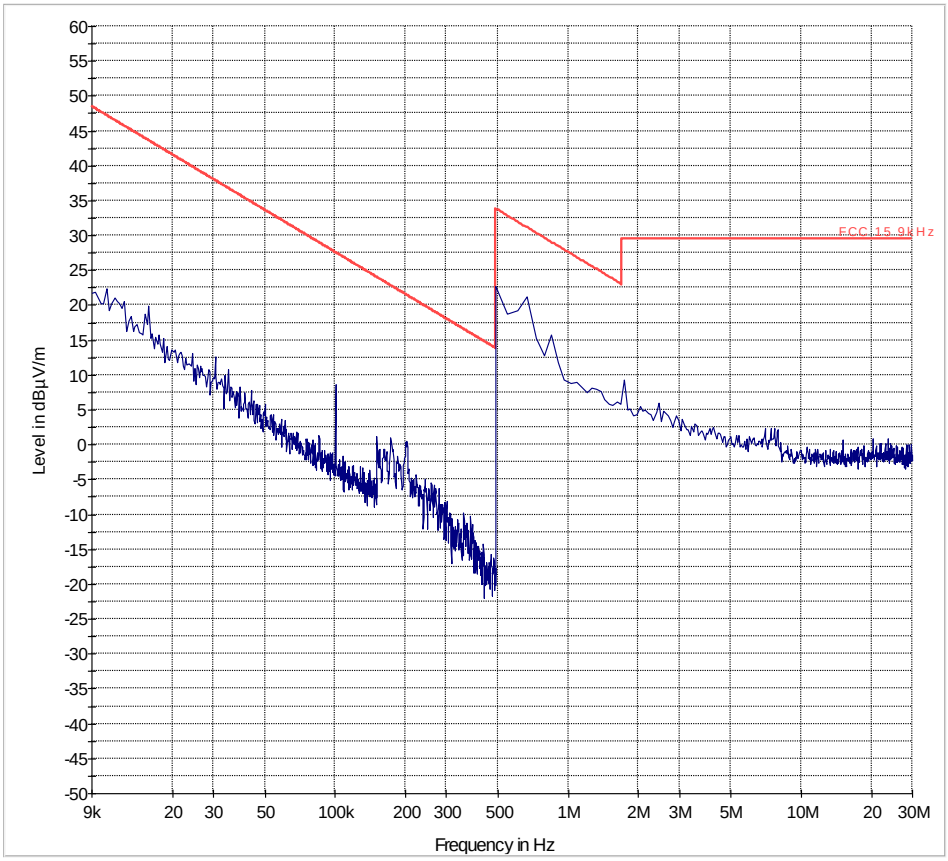
Measured fundamental field strength= **81.95dBµV/m** at 3m.

Extrapolated reading at 300 m= **81.95dBµV/m** - 40*log(300/3)= **1.95 dBµV/m**

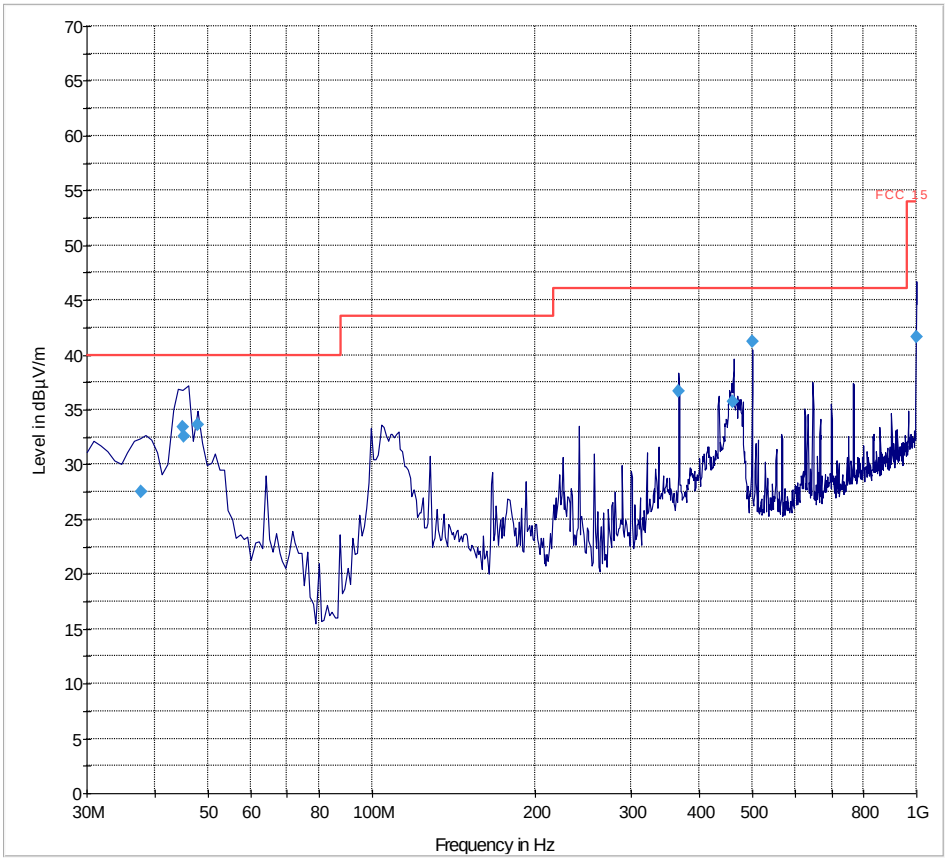


5.1.5.3 Test Verdict:
Pass

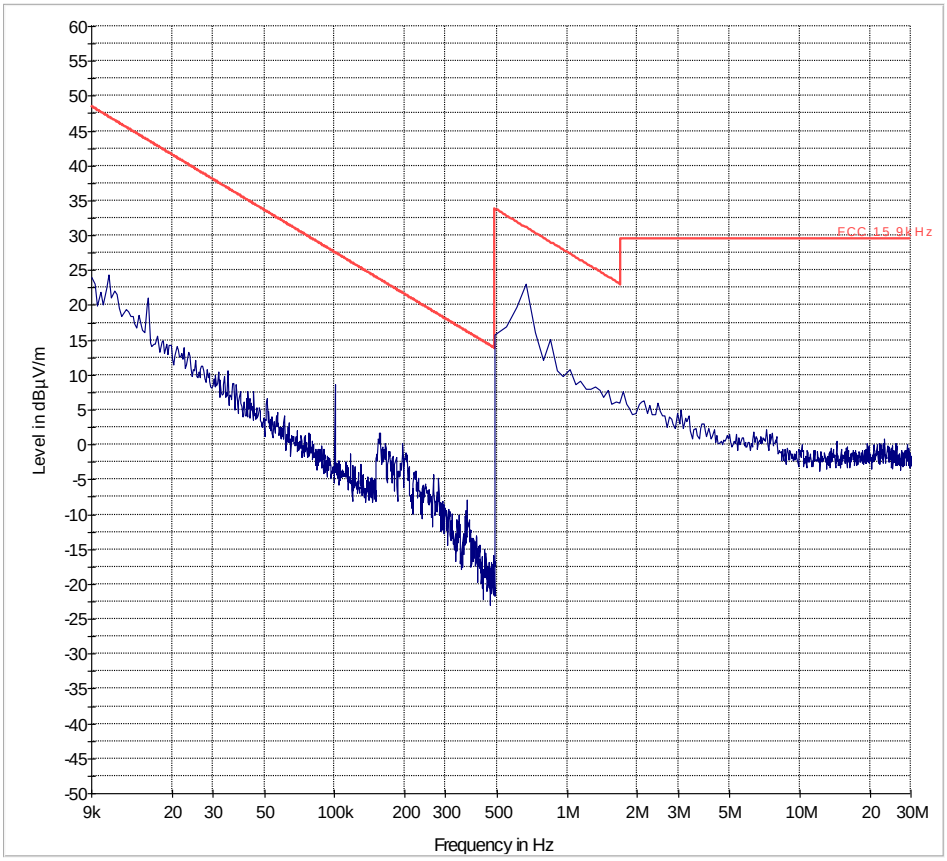
Radiated Emissions 9 KHz- 30 MHz: Tx Mode



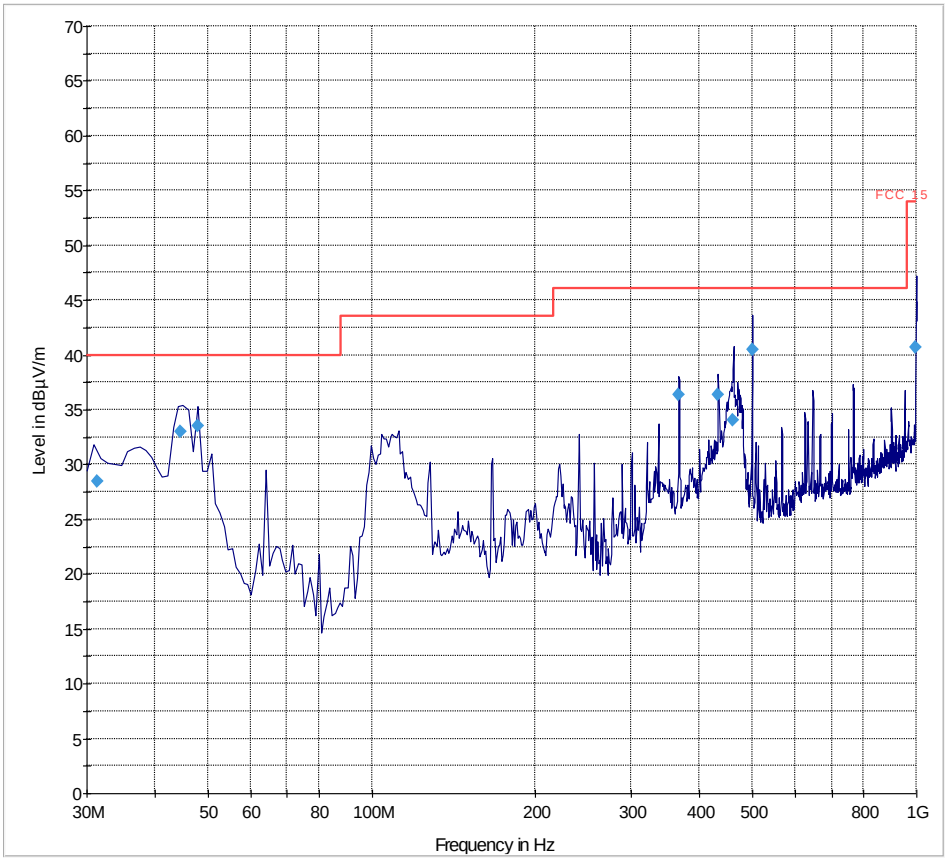
Radiated Emission: 30MHz – 1GHz Tx mode



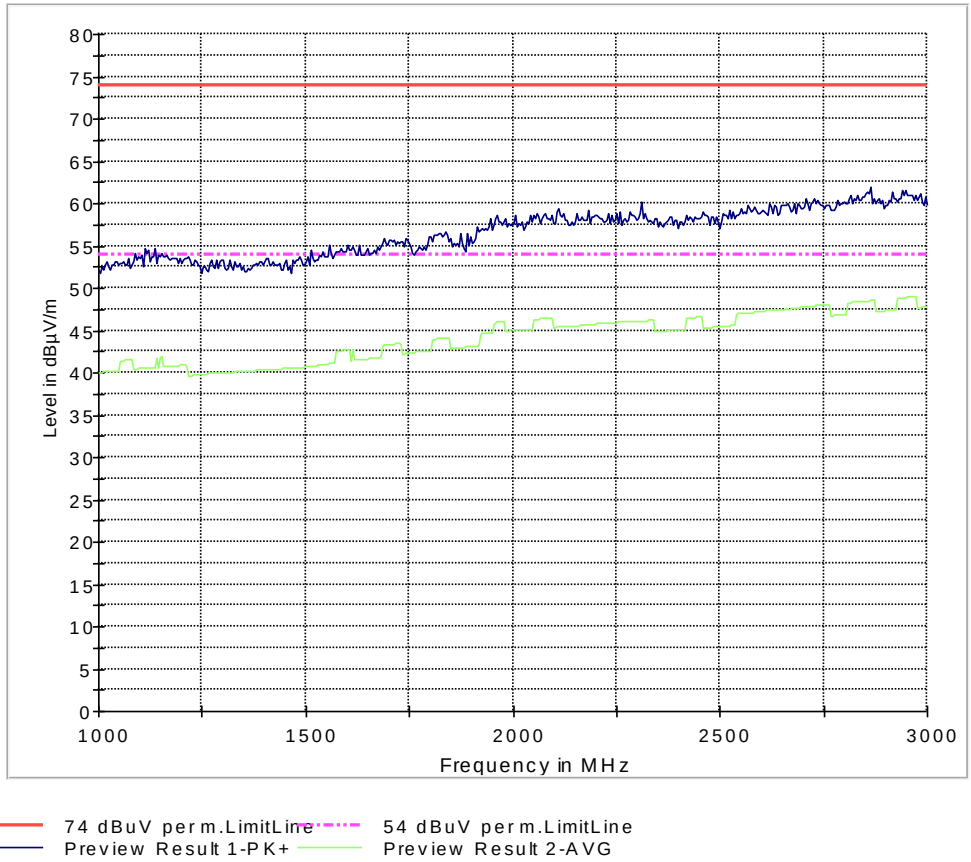
Radiated Emissions 9 KHz- 30 MHz: Rx Mode



Radiated Emission: 30 MHz – 1 GHz Rx mode



Radiated Emission: 1 GHz – 3 GHz Rx mode



5.2 Bandwidth of the Modulated Carrier.

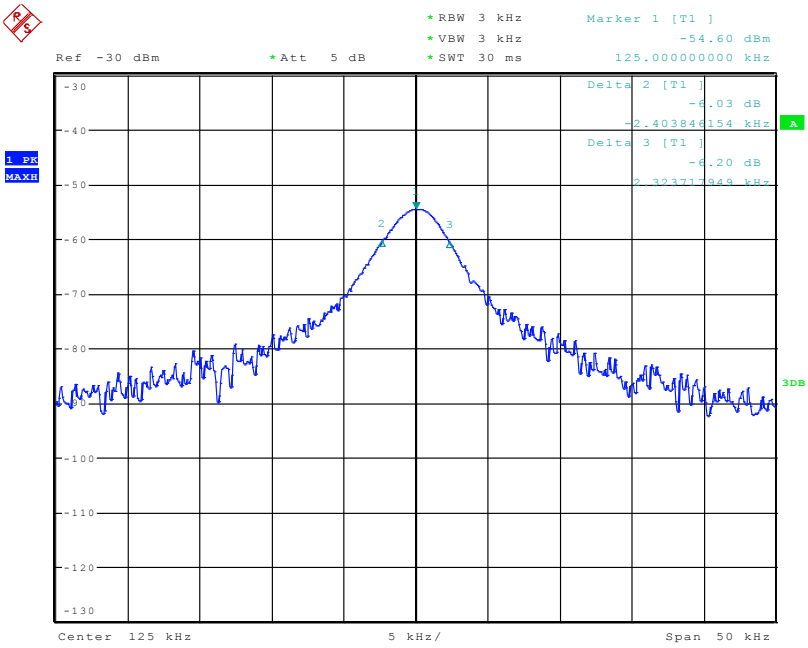
5.2.1 References:

IC RSS-210

5.2.2 **Result:** For Reference only.

	Occupied bandwidth (KHz)
6 dB (75%)	4.73
20 dB (99%)	14.66

6dB (75%) bandwidth



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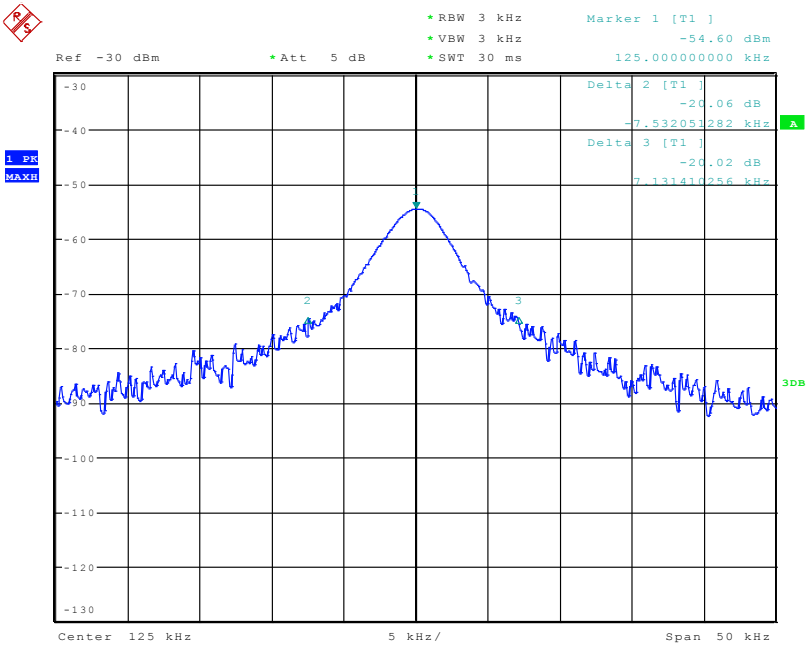
20dB (99%) bandwidth



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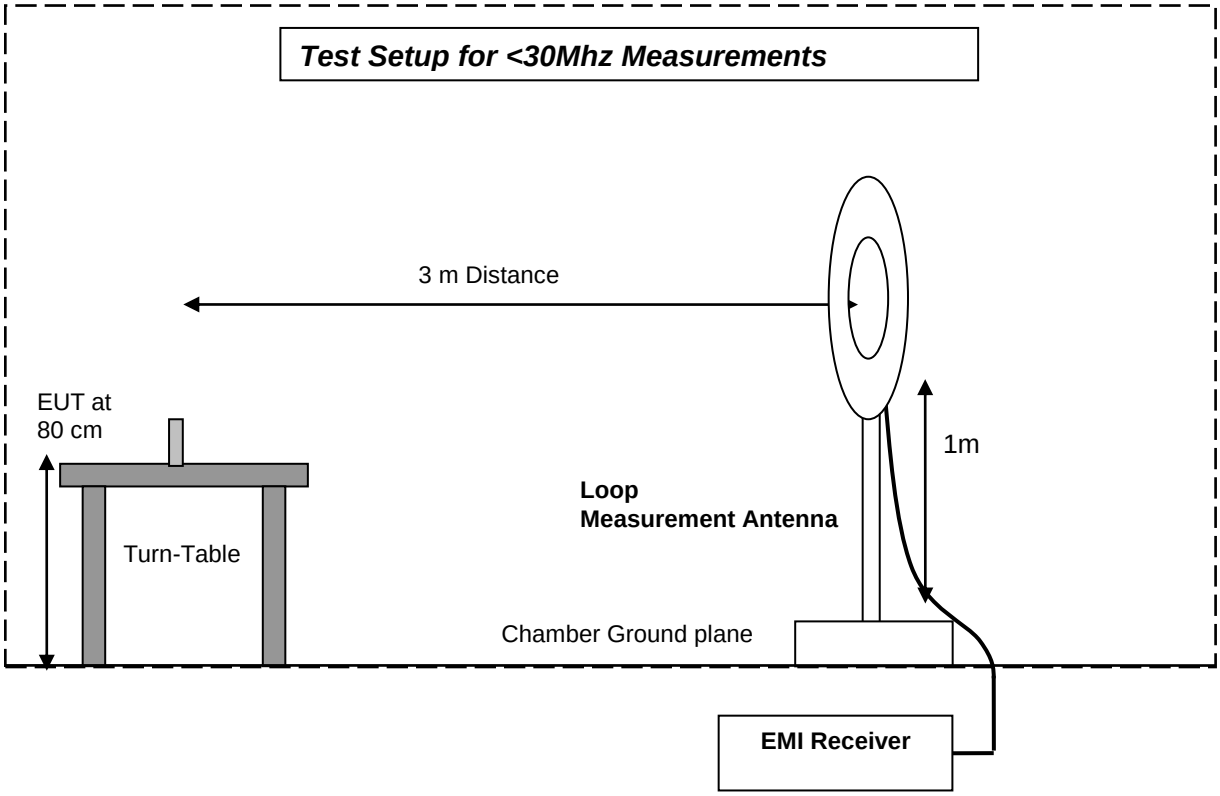
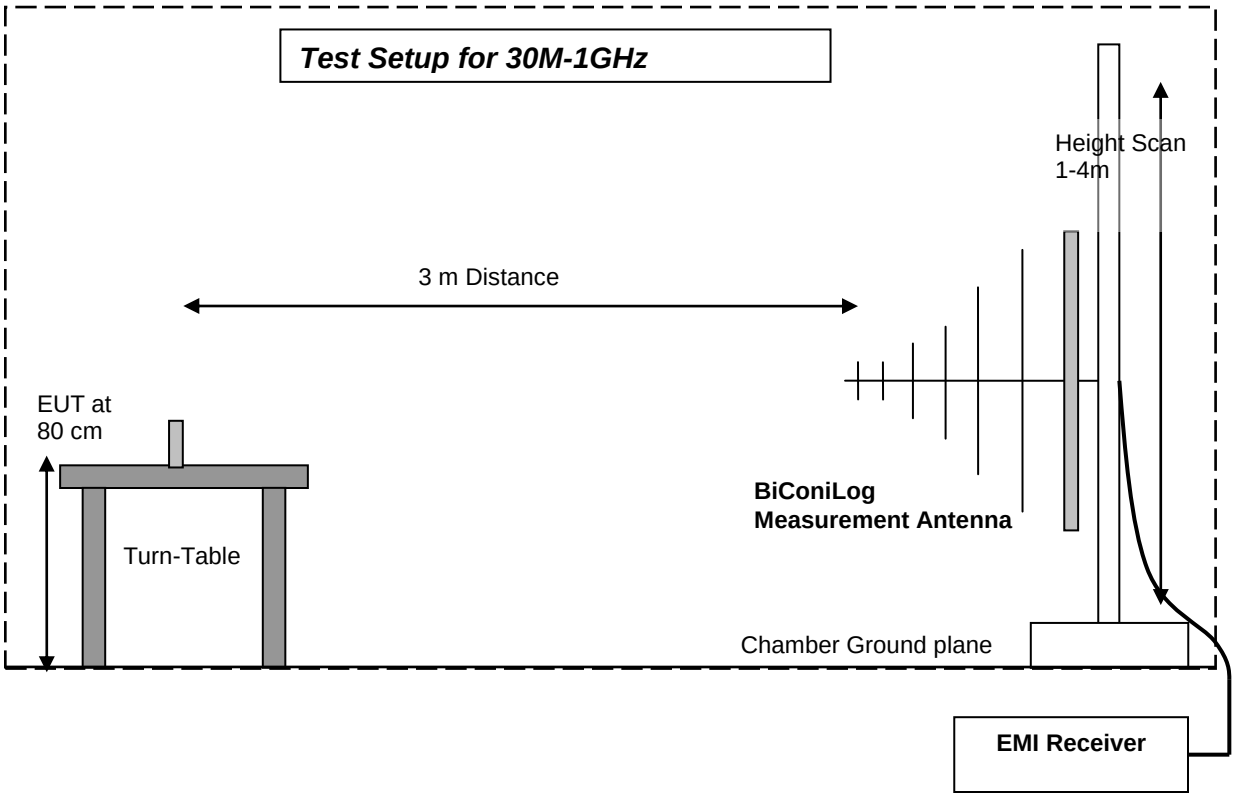
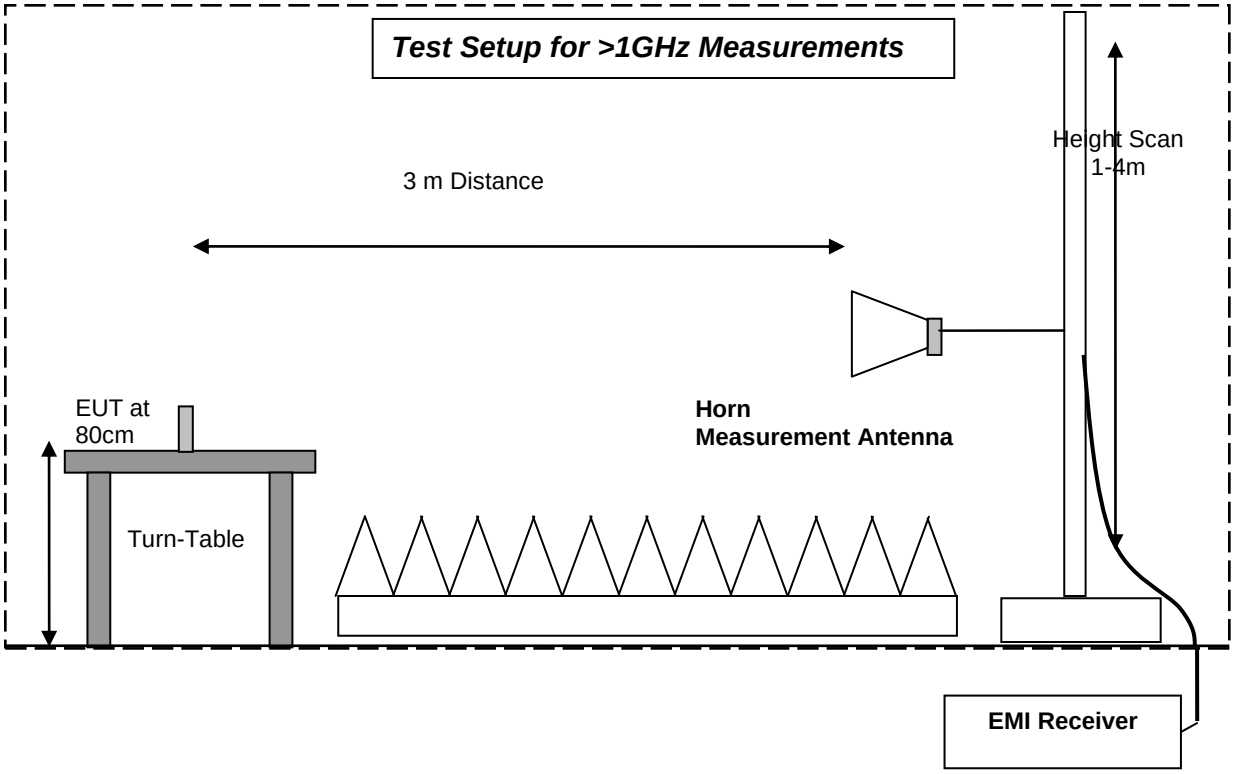
6 Test Equipment and Ancillaries used for tests

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
EMI Receiver/Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2011	2 Years
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	May 2011	2 Years
BiConiLog Antenna	3141	ETS	0005-1186	Apr 2012	3 Years
Loop Antenna	6512	EMCO	00049838	Aug 2011	3 years
Communication Antenna	IBP5-900/1940	Kathrein	n/a	n/a	n/a
High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
DC Power Supply	E3610A	Hewlett Packard	KR83021224	n/a	n/a
DC Power Supply	6655A	Hewlett Packard	3403A-00487	n/a	n/a
Multimeter	MM200	Klein	N/A	Apr 2011	2 Years
Temp Hum Logger	TM320	Dickson	03280063	Mar 2012	1 Year

7 Test Setup Diagrams






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

8 Report History

Date	Report Name	Changes to report	Report prepared by
2012-04-13	EMC_MARQU_004_12001_WIN	First Version	T Yusuf
2012-06-20	EMC_MARQU_004_12001_WIN_Rev1	.Updated Applicant info Sec 2.2.(Pg. 4) .Corrected calculated Field Strength. (Pg.13) .Corrected Sample Calculation (Pg. 12) . Removed Transmitter timing info. (Pg. 8)	T Yusuf