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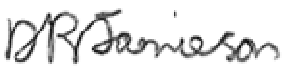
Test Report for Micro-Talk Gateway

To Federal Communications Commission Code of Federal Regulations – Title 47: Telecommunications; Part 15

Model Number	E70361		
Product Description	Micro-Talk Gateway		
Project Number	0903		
Report Number	EMC2030/004		
Report Version	V1.01		
Report Author David Jamieson EMC Engineer		Date	1st December 2016
Technical Check Mike Thompson Senior EMC Engineer		Date	5th December 2016
Approval Andy Little Compliance Manager		Date	15th February 2017

Test Date Range	4th August to 29th September 2016

Product Status	**PASS**

The test data and results contained within this report relate only to the items tested.

1 Report History

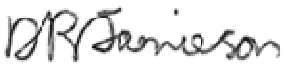
Version	Date	Reason for change
1.00	As cover sheet	Initial Issue
1.01	06/12/2016	D.Jamieson changes based on A. Little feedback. Sections 5.2 and 5.3 updated.

2 FCC CFR 47 Part 15 (September 2016) Test Summary

CFR 45 Part 15 Section	Title	Result	Report Section
15.209	Radiated Emissions Limits; General Requirements	Pass	6.1
15.249 (a)	Operation within the bands 902-928MHz: field strength fundamental and harmonics	Pass	6.2
15.33	Frequency range of Radiated Measurements	Compliant	6.3
15.35	Measurement Detector Functions and Bandwidths	Compliant	6.4
15.203	Antenna Requirement	Compliant	6.5
15.205	Restricted Bands of Operation	Compliant	6.6
15.249 (b)	Fixed Point-To-Point Operation	N/A	6.7
15.249 (c)	Field Strength Distance	Compliant	6.8
15.249 (d)	Radiated Emissions Outside Specified Frequency Bands	Compliant	6.9
15.249 (e)	Peak Measurements	Compliant	6.10

3 Attestations

This equipment has been tested in accordance with the standards identified in this report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in these reports.
All measuring instruments used to determine the status of the product's compliance to the identified standards are calibrated regularly in accordance with UKAS requirements.
A comprehensive system of traceable calibration in accordance with ISO9001 is maintained.

Name/Position	Signature	Date
David Jamieson EMC Engineer		1st December 2016

I attest that the necessary measurements were made, under my supervision at Raymarine UK Ltd, Marine House, Cartwright Drive, Fareham, PO15 5RJ.

Andy Little
Compliance Manager

Date: 15th February 2017

TABLE OF CONTENTS

4 Test Information

4.1 Test Facilities

Area	Site ID	Room Type	Test	Room Dimensions	Comments
A	Site 2	Fully Anechoic, Free Space Chamber	Radiated Immunity	8m x 4m x 3m	Test system for uniform RF calibrated in-house.
	Site 4	Screened Room	Not used	6m x 3m x 2.5m	GND reference plane: 2.00m x 1.15m
	Site 5	Screened Room	Not used	2m x 3m x 2.5m	
	Site 6	Screened Room	CRFI & FTB	4m x 3m x 2.5m	GND reference plane: 1.25m x 2.50m
	Site 7	Screened Room	Not used	2m x 3m x 2.5m	
	Site 8	Screened Room	Conducted Emissions	4m x 3m x 2.5m	GND reference plane: 1.25m x 2.50m
	Site 9	Surge & ESD 'office' Room	VVR & ESD	6m x 4.5m x 2.5m	GND reference plane: 5.00m x 2.00m GND plane: 1.00m x 2.00m
B	Site 1	Semi Anechoic Chamber	Radiated Emissions	9m x 6m x 5.5m	FCC ID: 371673 IC Certification: 4069B-2
	Site 3	Screened Room	Not used	6m x 3m x 2.5m	GND reference plane 1: 1.25m x 2.50m GND reference plane 2: 1.05m x 2.00m
ET	ET Lab area	Lab Area	Tests over temp.	N/A – Open area	Environmental test area

4.2 Overall Test Conditions

Area	Date	Ambient Temperature (°C)		Relative Humidity (%)		Air Pressure (mbar)	
		Max	Min	Max	Min	Max	Min
B	04/08/2016	22.2	20.9	65.6	61.2	1005.8	1004.4
B	05/08/2016	22.3	20.6	62.9	60.2	1016.5	1014.3
B	09/08/2016	22.1	20.4	57.5	52.7	1021.8	1019.2
B	10/08/2016	21.8	20.1	55.1	51.9	1020.9	1019.4
B	11/08/2016	22.4	20.6	57.6	53.9	1018	1017.2
B	12/08/2016	22.4	21.4	59.6	56.3	1020.3	1018.1
ET	30/08/2016	N/A as work carried out in climatic chamber with user set temperature and humidity.				1020.4	1018.3
B	29/09/2016	21.9	21.4	65.2	60.2	1010.6	1009.3

5 EUT Information

5.1 Test Rationale

Tests of the Raymarine Micronet RF communication chain in the 915.92MHz band on the Micro-Talk Gateway product.

5.2 Description of Equipment under Test (EUT)

Date of Receipt:	10/08/2016
Client:	C. Hodgson
Brand Name:	Raymarine UK Ltd
Product Range:	Micro-Talk
Country of Manufacture:	Hungary
Operational voltage range:	12V(DC) 25mA Max

Unit 003

Model Name or Number:	E70361
Unique Type Identification:	EMC2030/003
Serial Number:	0760024
CCT Diagram Number(s) & Issue:	1005383-2
PCB Assembly Number(s) & Issue:	1005384-1
Software Version:	Custom software – Constant RF talker (916MHz)
Modifications to Unit:	None

Unit 004

Model Name or Number:	E70361
Unique Type Identification:	EMC2030/004
Serial Number:	0760008
CCT Diagram Number(s) & Issue:	1005383-2
PCB Assembly Number(s) & Issue:	1005384-1
Software Version:	Custom software – Constant RF listener (916MHz)
Modifications to Unit:	None

Unit 005

Model Name or Number:	E70361
Unique Type Identification:	EMC2030/005
Serial Number:	0760022
CCT Diagram Number(s) & Issue:	1005383-2
PCB Assembly Number(s) & Issue:	1005384-1
Software Version:	STng V0.00; RF V0.01
Modifications to Unit:	C203, C204 and R201 - removed C309 and C310 – value change from 1uF to 100nF

5.3 Additional information

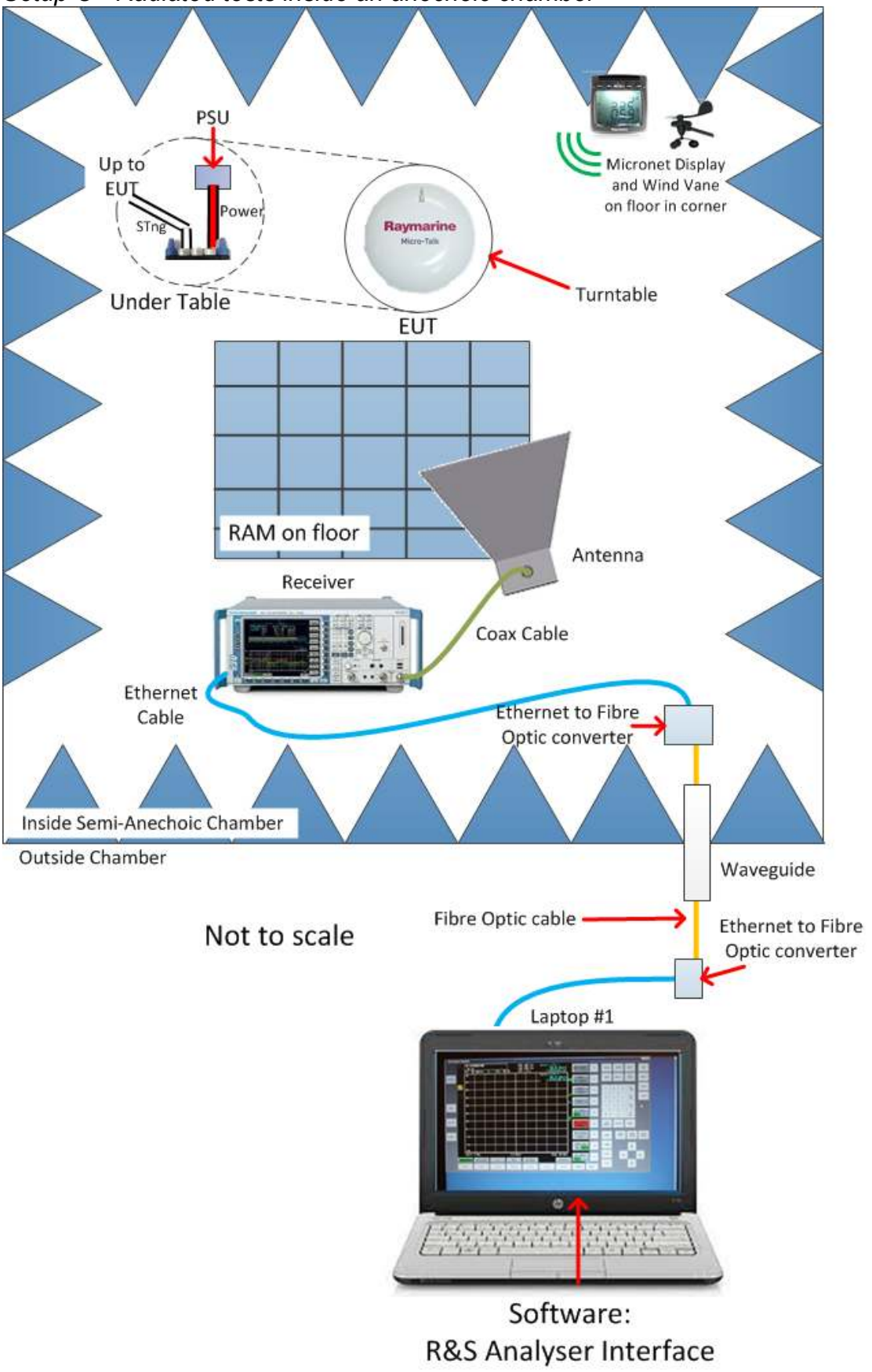
Unit 003 has custom software to force the RF processor into transmit (talk) only, with the STng communications processor disabled. Therefore, the unit no longer behaves like a normal unit and so it is only controlled with external power, off or on. Unit 004 has the same characteristics as 003, except that the RF receiver (listener) is on with the transmit off. Unit 005 has modifications to reduce the power supply noise. Unit 003 and 004 did not need this modification as their only job was to provide noise at the carrier and harmonics of 916MHz so the power supply noise would not effect these high up frequencies.

5.4 Description of Auxiliary Equipment

Product Type	Part Number	Serial Number
eS128	E70285	0450006
STng 5-way Connector	A06064	N/A
Micronet Dual Display	T110	22011RT111003
Micronet Wind Display	T112	0951158
Wind Transducer	T120	0951158

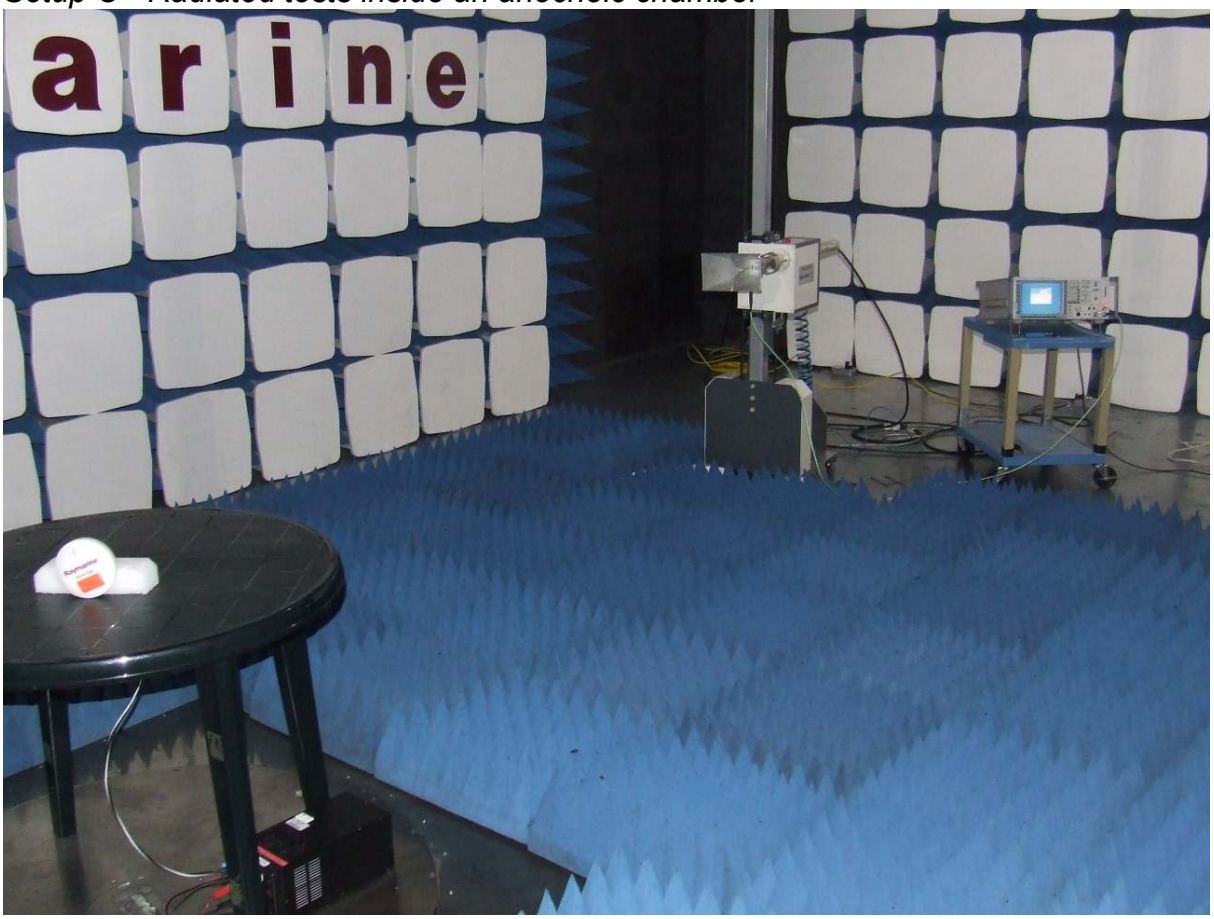
5.5 Test Configurations and Operating Modes

5.5.1 Setup C - Radiated tests inside an anechoic chamber



5.6 Test Photographs

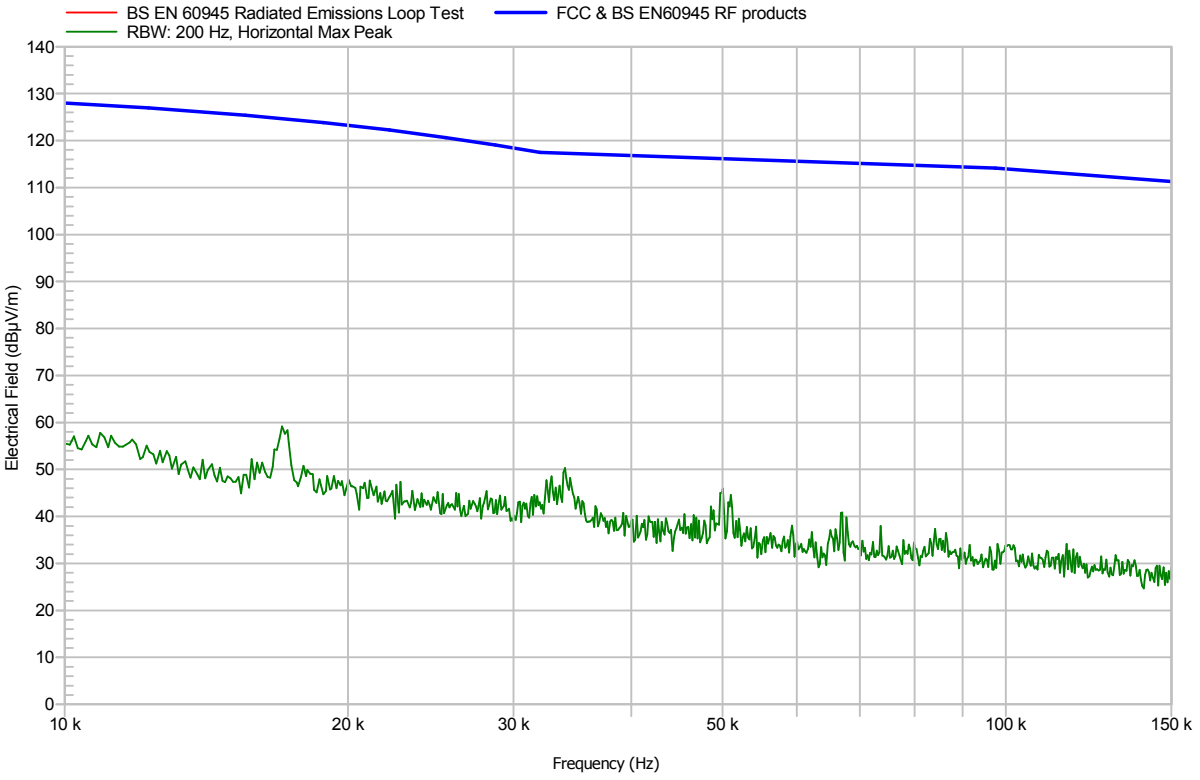
5.6.1 Setup C - Radiated tests inside an anechoic chamber



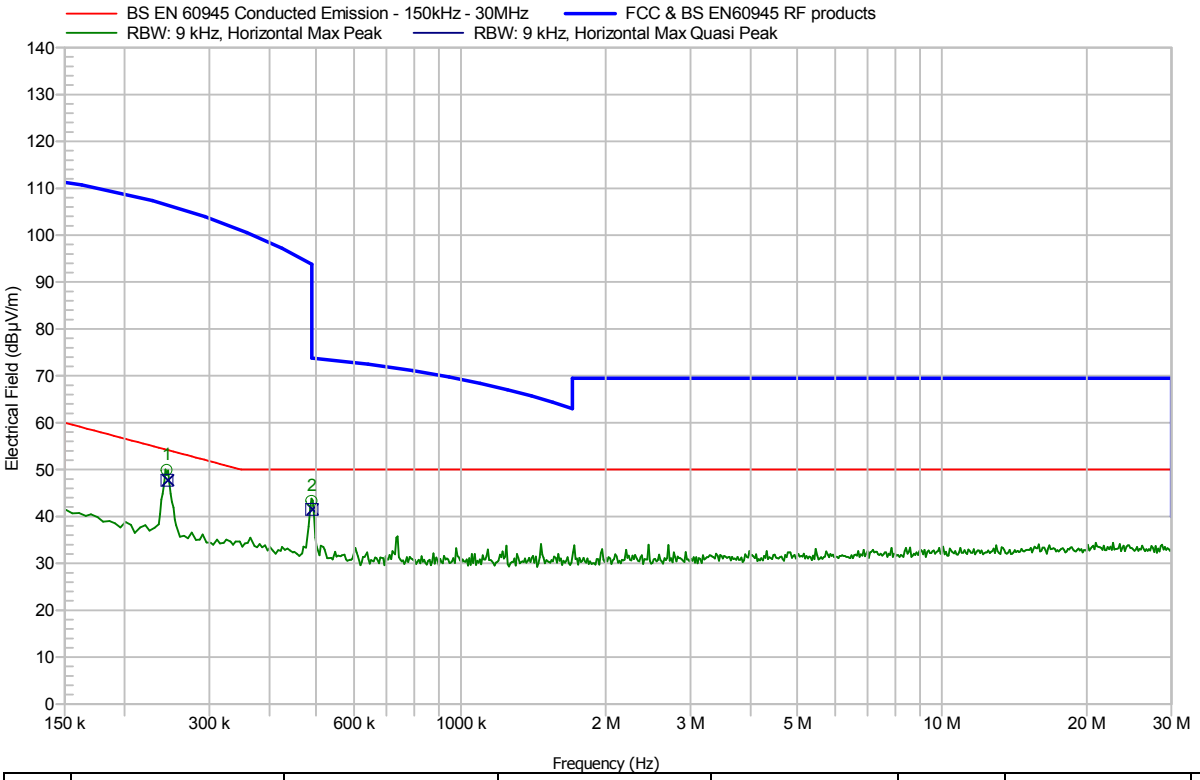
6 Test Results

6.1 Radiated Emissions Limits; General Requirements

6.1.1.1 10kHz to 150kHz – X Polarity (Side on)

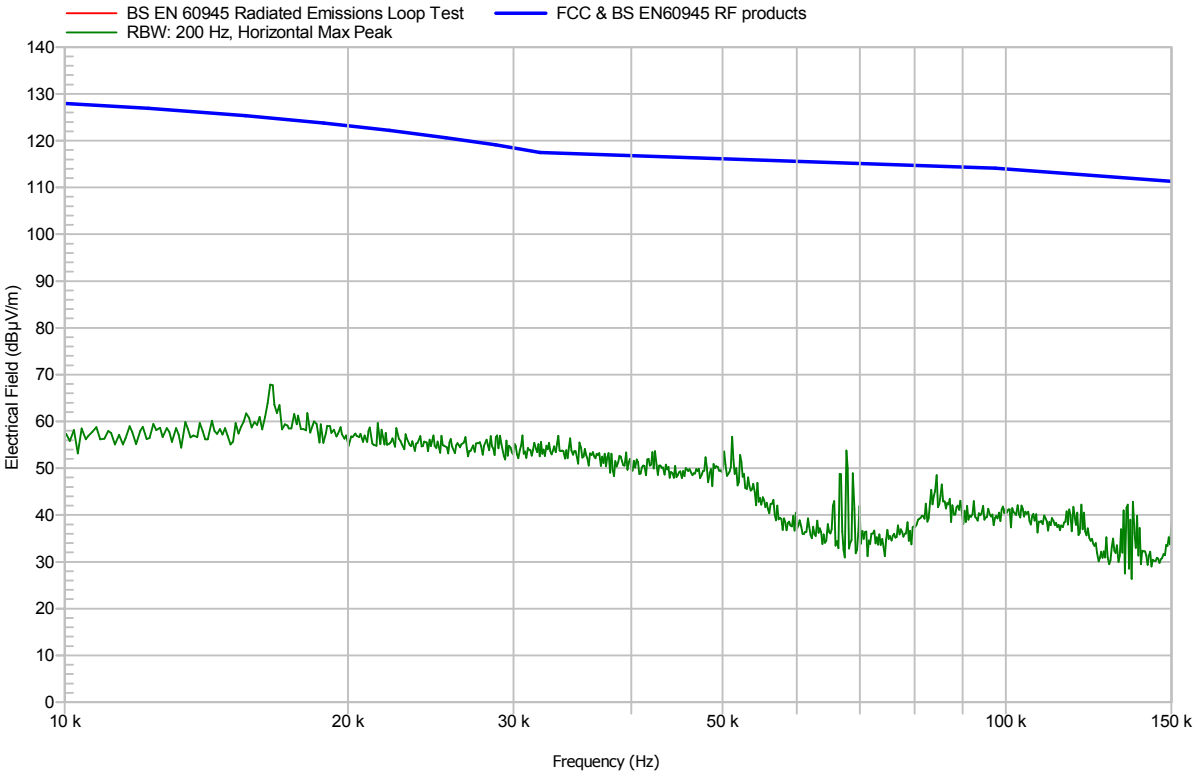


6.1.1.2 150kHz to 30MHz – X Polarity (Side on)

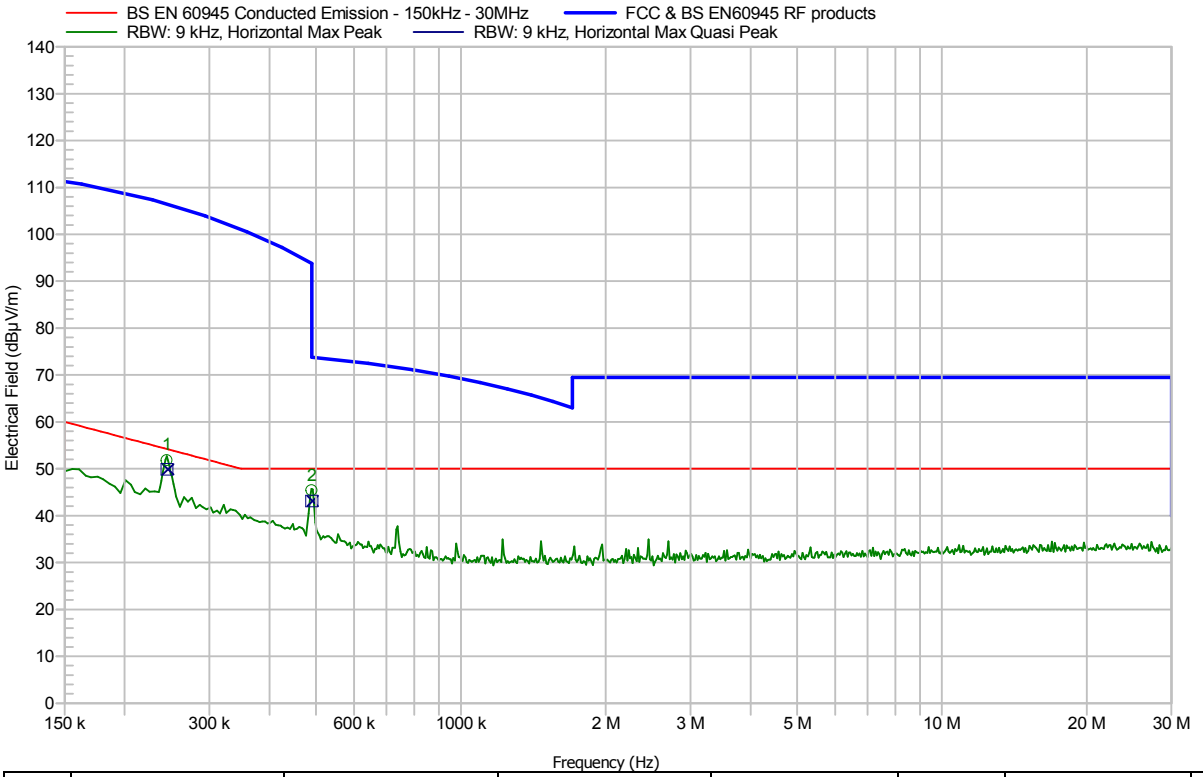


Nr	Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Polarization
1	245 kHz	49.83 dBµV/m	47.74 dBµV/m	-6.47 dB	Pass	0 Degree	Horizontal
2	490 kHz	43.28 dBµV/m	41.53 dBµV/m	-8.47 dB	Pass	0 Degree	Horizontal

6.1.1.3 10kHz to 150kHz – Y Polarity (Face on)



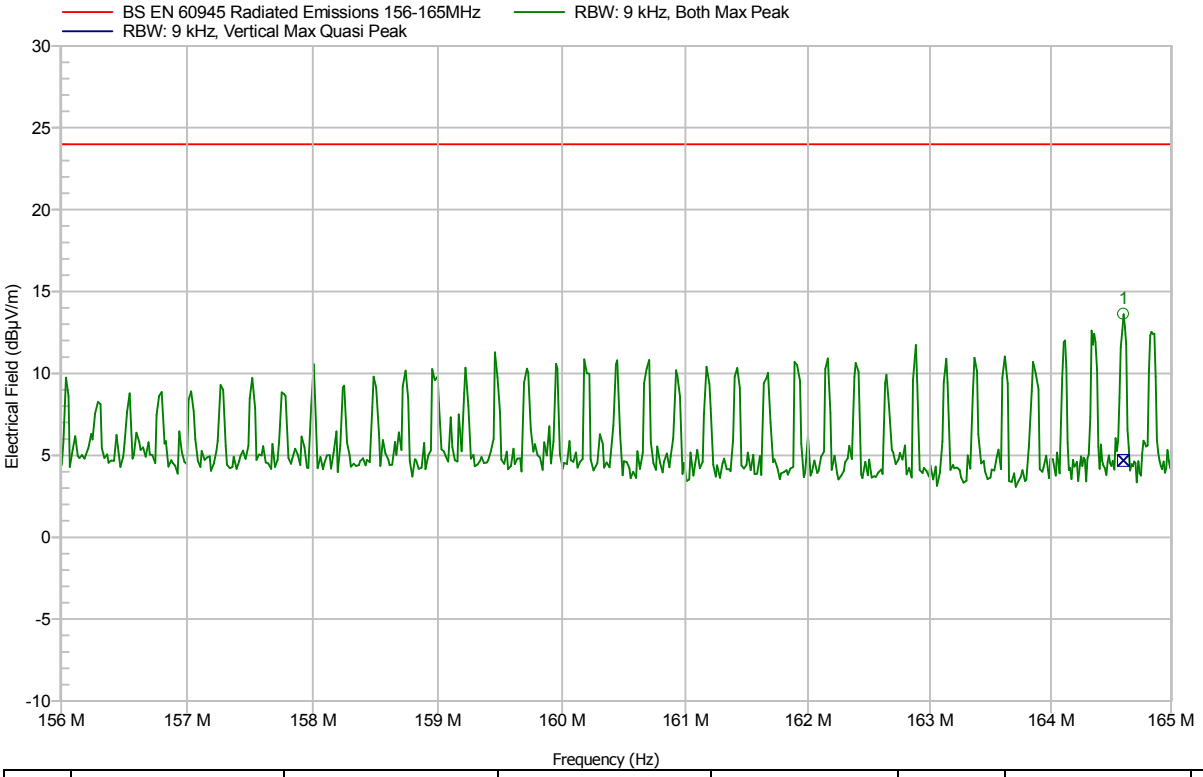
6.1.1.4 150kHz to 30MHz – Y Polarity (Face on)



Nr	Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Polarization

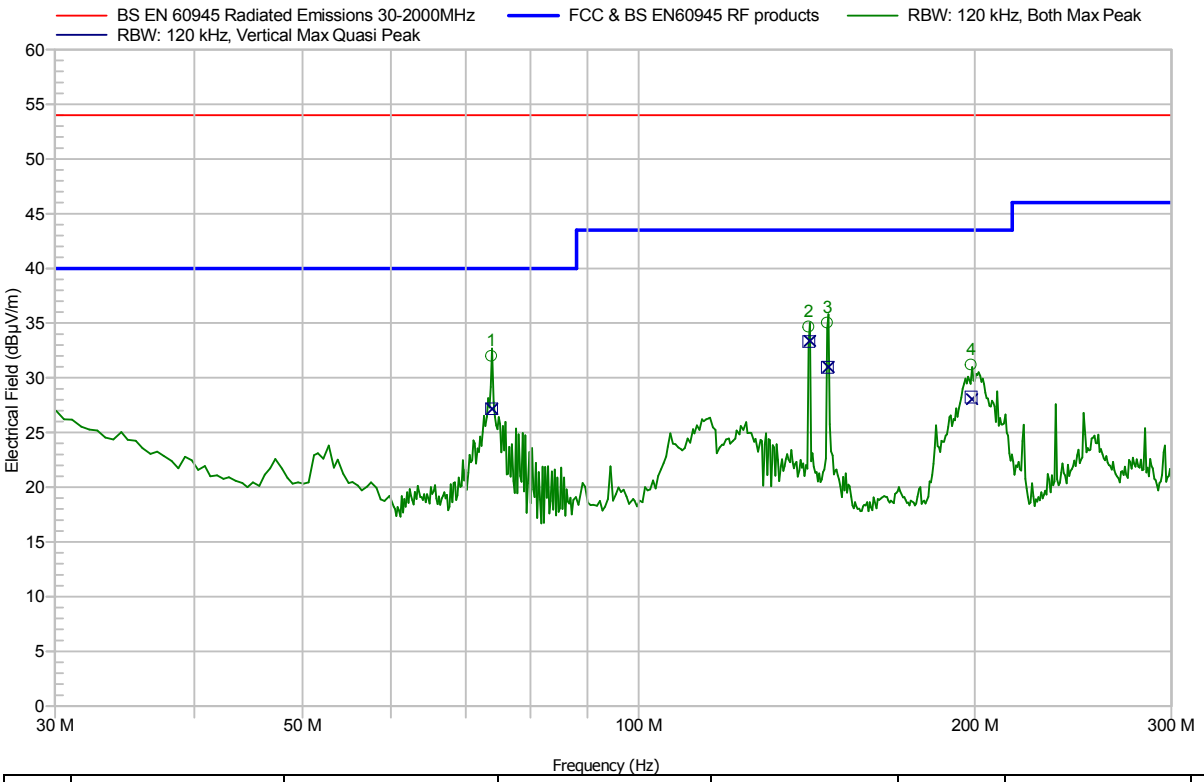
1	245 kHz	51.76 dBµV/m	49.89 dBµV/m	-4.32 dB	Pass	255 Degree	Horizontal
2	490 kHz	45.34 dBµV/m	43.13 dBµV/m	-6.87 dB	Pass	285 Degree	Horizontal

6.1.1.5 156MHz to 165MHz



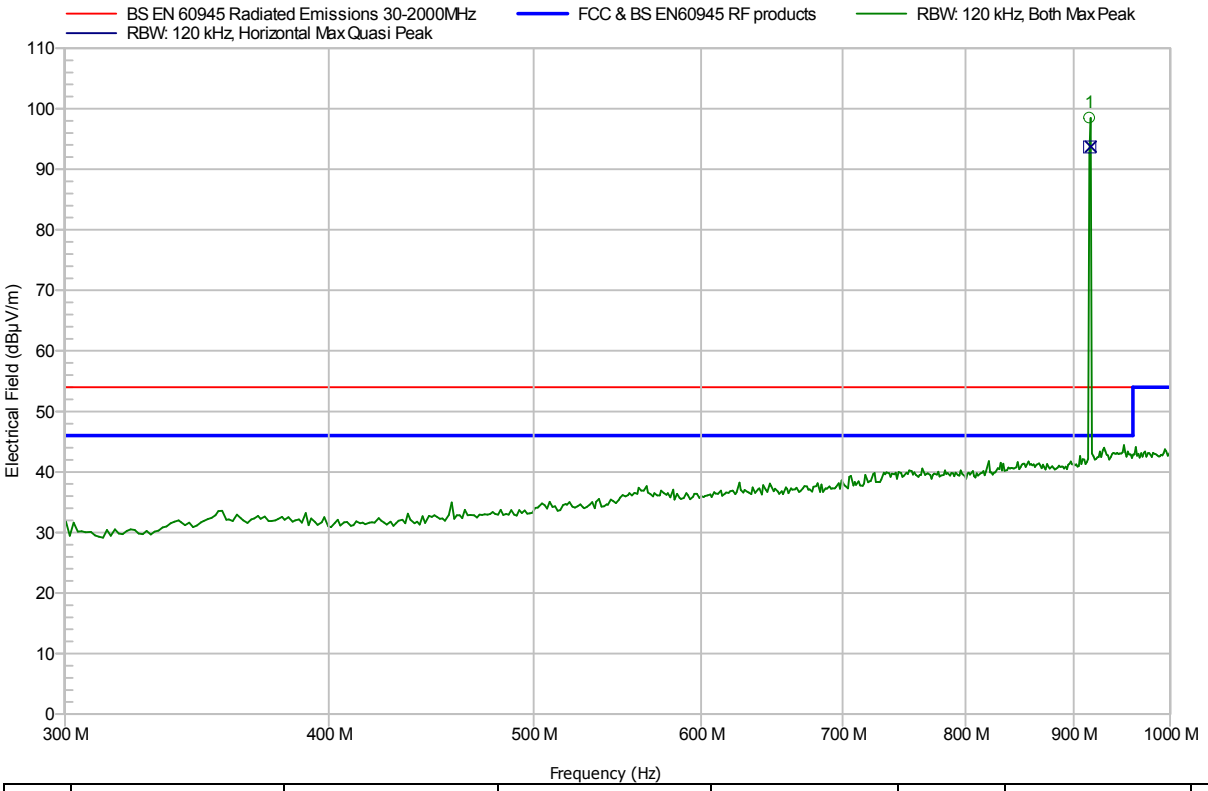
Nr	Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Polarization
1	164.601 MHz	13.62 dBµV/m	4.69 dBµV/m	-19.31 dB	Pass	0 Degree	Vertical

6.1.1.6 30MHz to 300MHz



Nr	Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Polarization
1	73.827 MHz	31.98 dBµV/m	27.18 dBµV/m	-12.82 dB	Pass	330 Degree	Vertical
2	142.002 MHz	34.65 dBµV/m	33.32 dBµV/m	-10.18 dB	Pass	165 Degree	Vertical
3	147.583 MHz	35.02 dBµV/m	30.96 dBµV/m	-12.54 dB	Pass	0 Degree	Vertical
4	198.48 MHz	31.18 dBµV/m	28.24 dBµV/m	-15.26 dB	Pass	0 Degree	Vertical

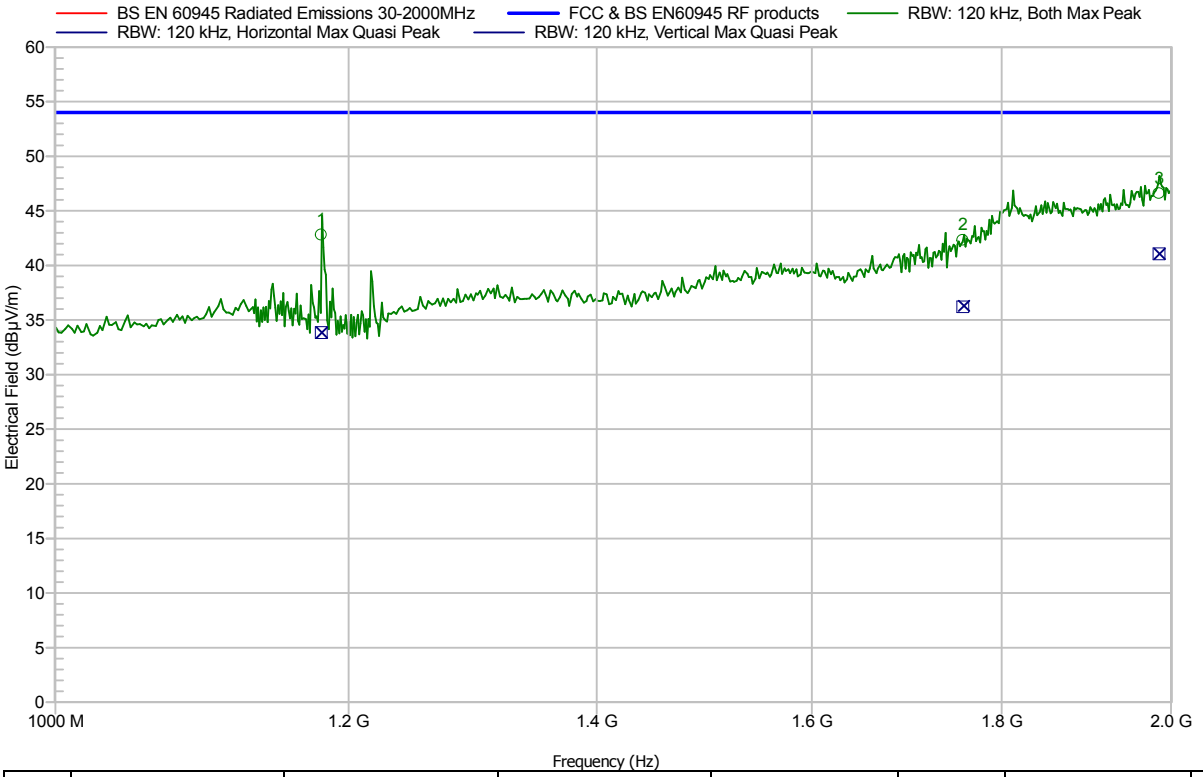
6.1.1.7 300MHz to 1GHz



Nr	Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Polarization
1	915.948 MHz	98.42 dBµV/m	93.66 dBµV/m	47.66 dB	Fail*	202 Degree	Horizontal

*Transmitter frequency.

6.1.1.8 1GHz to 2GHz

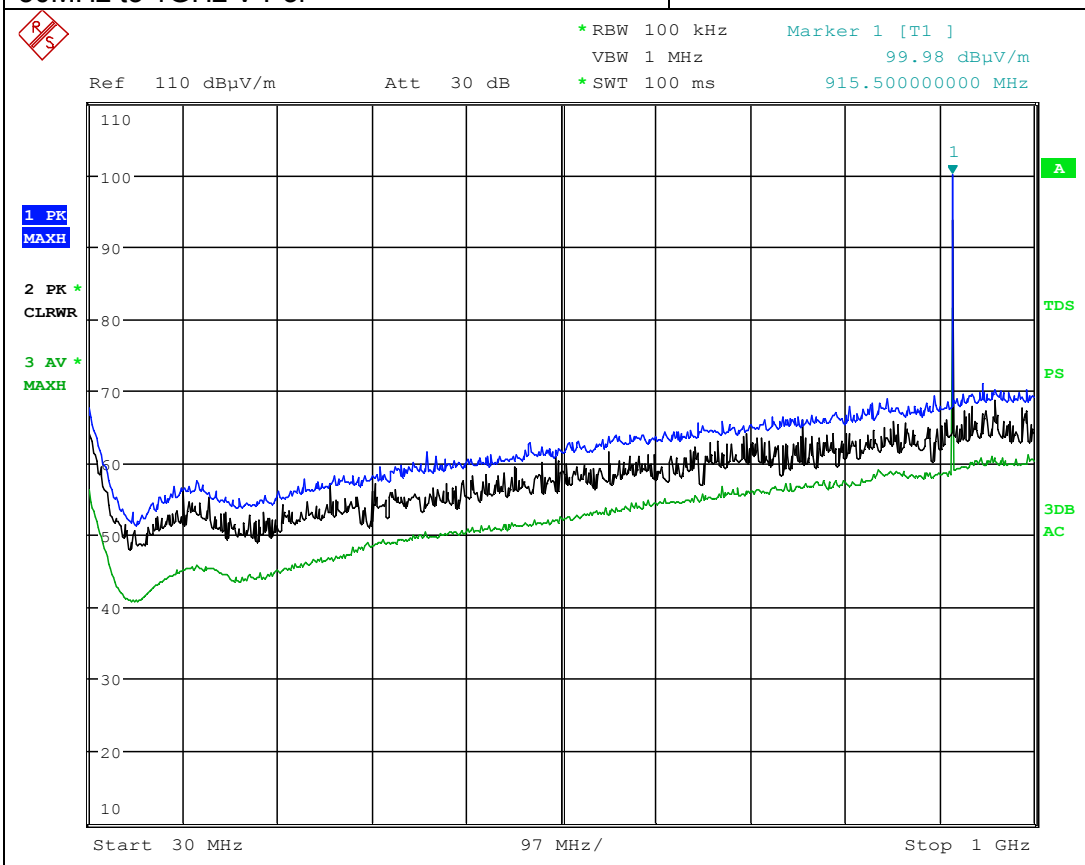


Nr	Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Polarization
1	1.18 GHz	42.79 dBµV/m	33.85 dBµV/m	-20.15 dB	Pass	292 Degree	Horizontal
2	1.757 GHz	42.32 dBµV/m	36.22 dBµV/m	-17.78 dB	Pass	30 Degree	Vertical
3	1.985 GHz	46.59 dBµV/m	41.06 dBµV/m	-12.94 dB	Pass	90 Degree	Horizontal

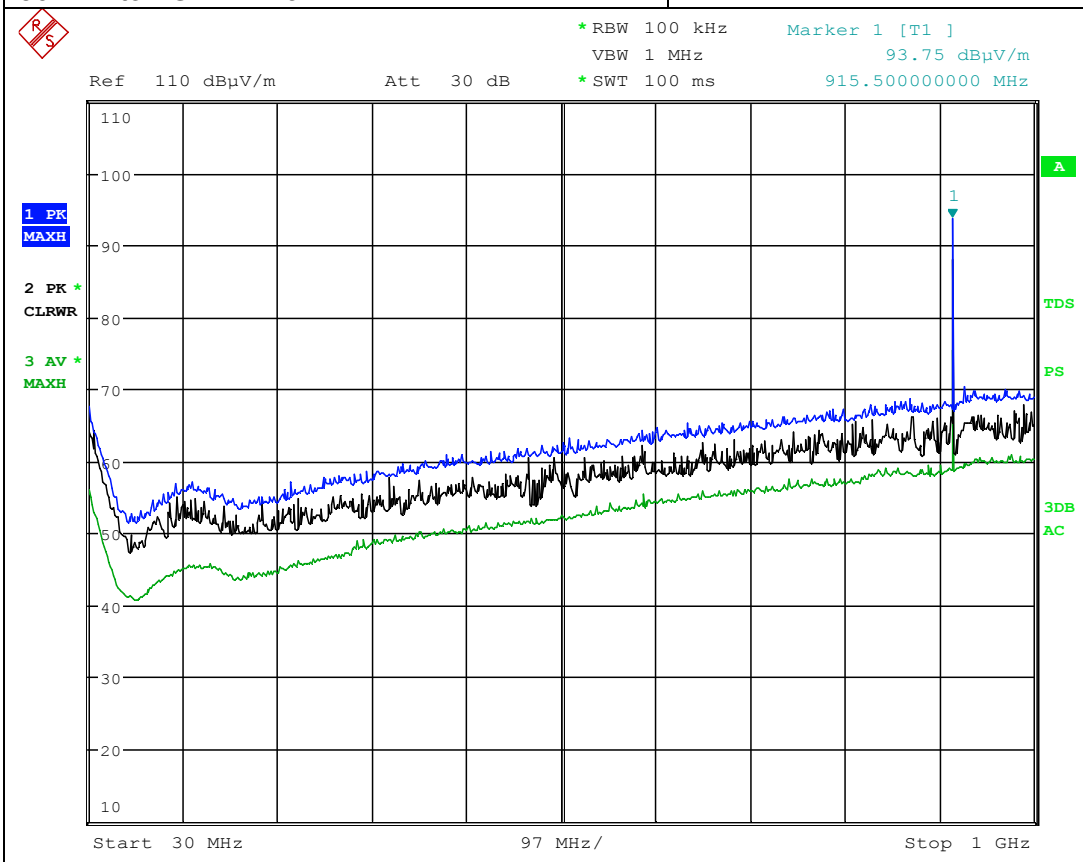
Comments: In the range 150kHz to 30MHz the measurement is performed as a receiver type, with a step size and 20ms dwell time.
In the ranges from 30MHz to 2GHz the measurement is performed as a spectrum analyser type, with 10 scans across a given band. The optimum measurement time for a single scan was selected at 5 seconds.
When peak levels were measured with quasi-peak, the dwell would be 1 second.
Test Unit: 005 and 003 (for 300MHz to 1GHz only)
Test Setup: C
Tested by: D. Jamieson
Test Date/s: 11th to 12th August 2016 (Unit 005) and 29th September 2016 (Unit 003)
Test Status: **PASS**

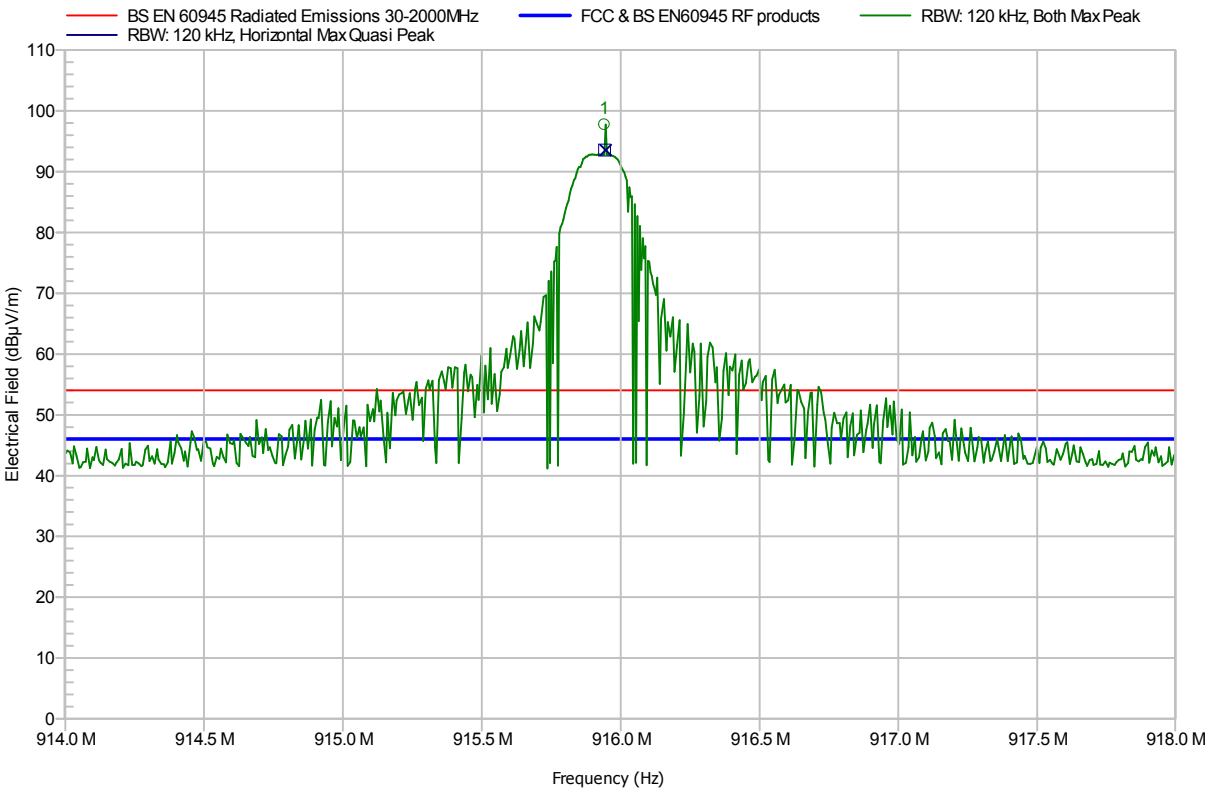
6.2 Operation within the bands 902-928MHz: field strength fundamental and harmonics

30MHz to 1GHz V Pol



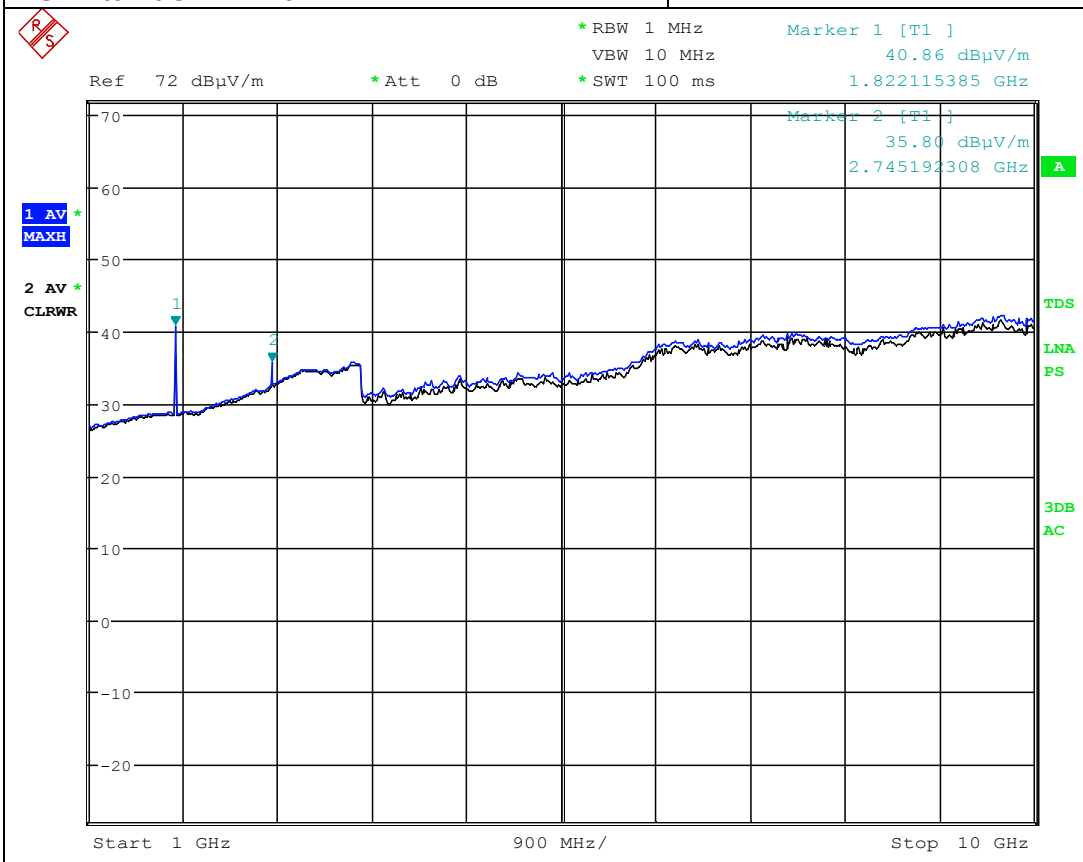
30MHz to 1GHz H Pol



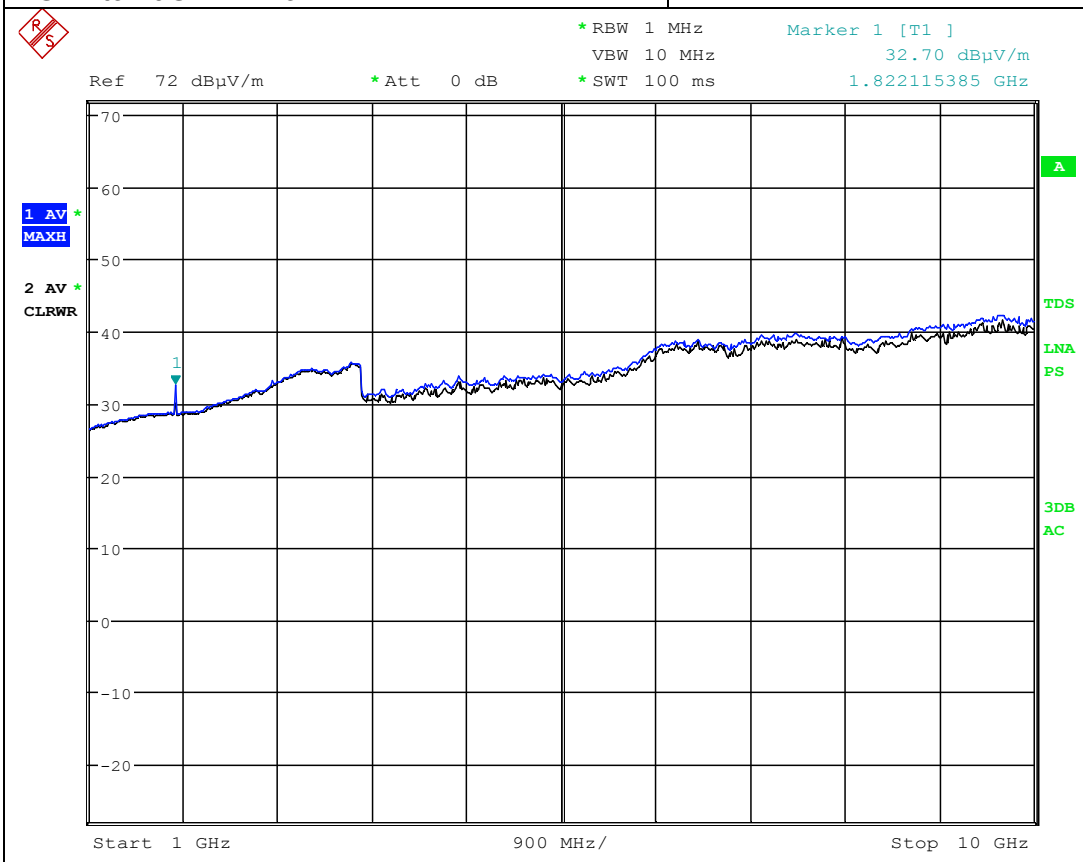


Nr	Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Polarization
1	915.941 MHz	97.71 dBµV/m	93.53 dBµV/m	0.43dB	Pass	202 Degree	Horizontal

1GHz to 10GHz V Pol



1GHz to 10GHz H Pol



Comments: Unit 003 ran in constant talker for 1GHz to 10GHz range, and with a 2% duty cycle for the 916MHz range to give correct quasi-peak level.
Test Unit: 003
Test Setup: D
Tested by: D. Jamieson
Test Date/s: 4th and 10th August and 29th September 2016
Test Status: **PASS**

6.3 Frequency range of Radiated Measurements

As seen in sections 6.1 and 6.2 above, the frequency range of measurements was from 9kHz to 10GHz.

Test Status: Compliant

6.4 Measurement Detector Functions and Bandwidths

The following measurement detector functions and bandwidths were used:

Report Section	Frequency Range	Detector	Final Measurement	Bandwidth
6.1	9kHz to 150kHz	Peak	N/A	200Hz
	150kHz to 30MHz	Peak	Quasi-Peak	9kHz
	30MHz to 2GHz	Peak	Quasi-Peak	120kHz
6.2	30MHz to 1GHz	Peak and Average	N/A	100kHz
	914MHz to 918MHz	Peak	Quasi-Peak	120kHz
	1GHz to 10GHz	Peak and Average	N/A	1MHz

Test Status: Compliant

6.5 Antenna Requirement

The EUT antenna is printed onto the PCB and in full production will not be able to be removed or bypassed by the user.

Test Status: Compliant

6.6 Restricted Bans of Operation

On review of results in section 6.1 and 6.2 of this report, no carrier frequency spikes are present in the table of frequency bands in FCC CFR 47 Part 15 section 15.205 (a).

Test Status: Compliant

6.7 Fixed Point-To-Point Operation

Comments: Not applicable.

6.8 Field Strength Distance

All tests were performed at a distance of 3 meters.

Test Status: Compliant

6.9 Radiated Emissions Outside Specified Frequency Bands

On review of results in section 6.1 and 6.2 of this report, emissions radiated outside of the specified frequency bands, except for harmonics, have be attenuated by at least 50 dB below the level of the fundamental.

Test Status: Compliant

6.10 Peak Measurements

As per section 6.4 of this test report, Average detector was used above 1GHz.

Test Status: Compliant

7 List of Test Equipment

In accordance with UKAS requirements, all measuring equipment is on a calibration cycle.

7.1 Setup C – Radiated RF in a semi anechoic chamber

Test Equipment Type	Manufacturer and Type Number	Serial Number	Cal No.	Cal Due
Semi-Anechoic Chamber, Site 1	Global EMC	GE001	02074	01/12/2017
EMI Receiver 9kHz-26.5GHz	R & S ESI26	832692/006	00886	23/11/2016
Loop Antenna 9khz - 30MHz	Chase HLA6120	29905	02475	02/10/2017
Loop Power Supply	Chase CBP9721	N/A	02671	N/A
EMI Receiver 20Hz-40GHz	R&S ESU40	100017	01721	07/12/2016
Broadband Antenna 20-2000MHz	Chase EMC CBL6141	4254	01323	25/03/2017
Antenna Horn 1-18GHz	Chase BBHA9120D	9120D-128	00852	16/11/2017
UHF Half Wave Dipole	Schwarzbeck UHA 9105	9105-2612	02858	04/04/2018
Signal Generator	Hewlett-Packard 8648C	3642U01465	01558	12/05/2017
Antenna Mast (Site 1)	Inn-co GmbH MM4000	MM4000/056/13750806/L	02075	Cal not required
Turntable (Site 1))	Inn-co GmbH DS1200S	DS1200S/175/13750806/L	02076	Cal not required
Mast/Turntable Controller (Site 1)	Inn-co GmbH Co 2000	CO/2000/359/137/50806/L	02077	Cal not required
Power Supply Unit	Palstar PS30M	G450673814	01934	Not Calibrated