



EMISSIONS TEST REPORT

Report Number: 101602013BOX-001b

Project Number: G101602013

Report Issue Date: 05/29/2014

Product Designation: PRD-1102196002

Standards: CFR47 Part 15 Subpart C 15.247 (2014)
CFR47 Part 15 Subpart B (2014)
IC RSS-210 Issue 8 December 2010 Annex 8
IC RSS-Gen Issue 3 December 2010+Notice 2012-DRS0126
IC ICES-003 Issue 5 August 2012
IC RSS-102 Issue 4 March 2010 updated December 2010

Tested by:
Intertek Testing Services NA, Inc.
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Boxborough, MA 01719 U.S.A

Client:
QinetiQ North America, Technology Solutions Group
350 Second Ave.
Waltham, MA 02451 U.S.A

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Report reviewed by

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1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 3.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test	--
5	System Setup and Method	--
6	Maximum Peak Output Power, Human RF Exposure, & Duty Cycle CFR47 FCC Part 15 Subpart C (2014), Section 15.247 (b)(3) IC RSS-210 Issue 8 December 2010, A8.4 (4) IC RSS-102 Issue 4 March 2010 updated December 2010	Pass
7	Transmitter Radiated Spurious Emissions CFR47 FCC Part 15 Subpart C(2014), Section 15.247 (d) IC RSS-210 Issue 8 December 2010, A8.5	Pass
8	6 dB Bandwidth & 99% Power Bandwidth CFR47 FCC Part 15 Subpart C (2014), Section 15.247 (a)(2) IC RSS-210 Issue 8 December 2010, A8.2 (a)	Pass
9	Power Spectral Density CFR47 FCC Part 15 Subpart C (2014), Section 15.247 (e) IC RSS-210 Issue 8 December 2010, A8.2 (b)	Pass
10	Band-edge Compliance CFR47 FCC Part 15 Subpart C (2014), Section 15.247 (d) IC RSS-210 Issue 8 December 2010, A8.5	Pass
11	Digital Devices Radiated Spurious Emissions CFR47 FCC Part 15:2013 Subpart B Section 15.109 IC ICES-003 Issue 5 August 2012	Pass
--	Receiver Radiated Spurious Emissions CFR47 FCC Part 15 Subpart B (2014), Section 15.109 IC RSS-Gen 3 December 2010, Section 6	Exempt, above 960 MHz
12	AC Mains Conducted Emissions CFR47 FCC Part 15 Subpart B (2014), Section 15.207 IC RSS-Gen Issue 3 December 2010, 7.2.2 (Table 2)	Pass
13	Revision History	--

3 Client Information

This EUT was tested at the request of:

Company: QinetiQ North America, Technology
Solutions Group
350 Second Ave.
Waltham, MA 02451 U.S.A

Contact: Dan. Binnun
Telephone: (781) 684-3944
Fax: (781) 890-4084
Email: Dan.Binnun@qinetiq-na.com

4 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
See below	QinetiQ North America, Technology Solutions Group	PRD-1102196002	Prototype

Receive Date:	04/10/2014 & 05/17/2014
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)

The RF Dongle is comprised of one printed circuit assembly which includes circuitry for handling communication with a mobile tablet as well as a radio for communication. The MSP430F47183IPZR is the main processing unit for the RF Dongle. The purpose of the RF Dongle is to facilitate the transmission of information from a Setup Tool to the connected mobile tablet. The mobile tablet then passes this information to a Collector, so the Feeder Meter Systems are calibrated.

Communications

The RF Dongle is connected via a USB port to a mobile tablet, and the information is translated by the USB UART IC. The device has one 2.4GHz ISM band radio that communicates with a Setup Tool. This radio system utilizes a -0.2 dBi 1/4-wave right angle antenna, and a Texas Instruments radio, which operates frequencies of 2.465-2.479 GHz and has 8 configurable receiver channels.

Equipment Under Test Power Configuration

Rated Voltage	Rated Current	Rated Frequency	Number of Phases
The RF Dongle uses an USB a connection with a mobile tablet to receive power. The USB connection delivers 5 VDC power to the USB UART IC, which then powers a voltage regulator at the same level. The voltage regulator makes 3.3VDC.			

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Transmit
2	Receive

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	Pre-programmed

5 System Setup and Method

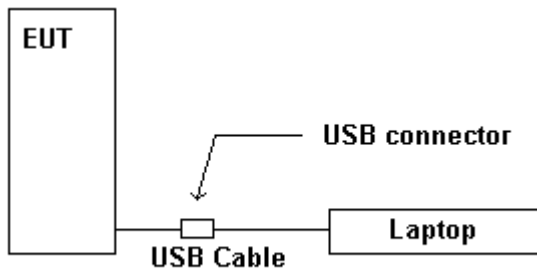
Cables					
Qty	Description	Length (m)	Shielding	Ferrites	Termination
1	USB	1	Braid	None	Laptop

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop	HP	Compaq nc6400	CND7021X0W

5.1 Method:

Configuration as required by ANSI C 63.4:2009, FCC Part 15 Subpart C (2014) Section 15.247, RSS-210 Issue 8 December 2010, RSS-Gen Issue 3 December 2010, KDB558074 V03:2013, and ANSI C63.10:2013.

5.2 EUT Block Diagram:



6 Maximum Peak Output Power, Human RF Exposure, & Duty Cycle

6.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10:2013, ANSI C63.4:2009, RSS-102, FCC Part 2.1093, KDB558074 V03:2013, and RSS-210 Annex 8.

TEST SITE: EMC Lab & 10m ALSE

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A wooden table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) $< U_{CISPR}$ (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dB μ V/m

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB μ V

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$
$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61A	09/25/2012	09/25/2014
ROS001'	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	04/25/2013	05/02/2014
WEI18'	20 dB, Attenuator DC-18GHz	Weinschel Corp	47-20-34	BP0570	03/26/2014	03/26/2015
CBL030'	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	04/05/2014	04/05/2015
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/17/2014	03/17/2015
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	01/06/2014	01/06/2015
145-416'	Cables 145-400 145-402 145-404 145-408	Huber + Suhner	3m Track B cables	multiple	10/04/2013	10/04/2014
MAN1'	Digital 4 Line Barometer	Mannix	OABA116	MAN1	08/13/2012	08/13/2014

Software Utilized:

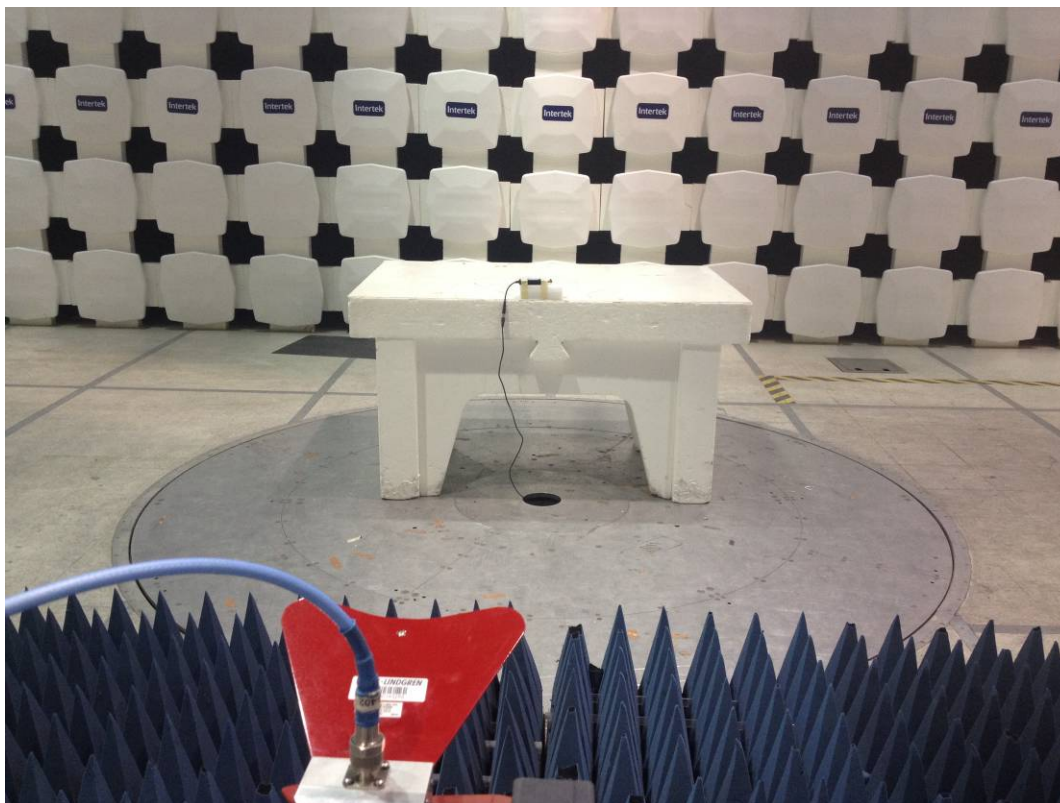
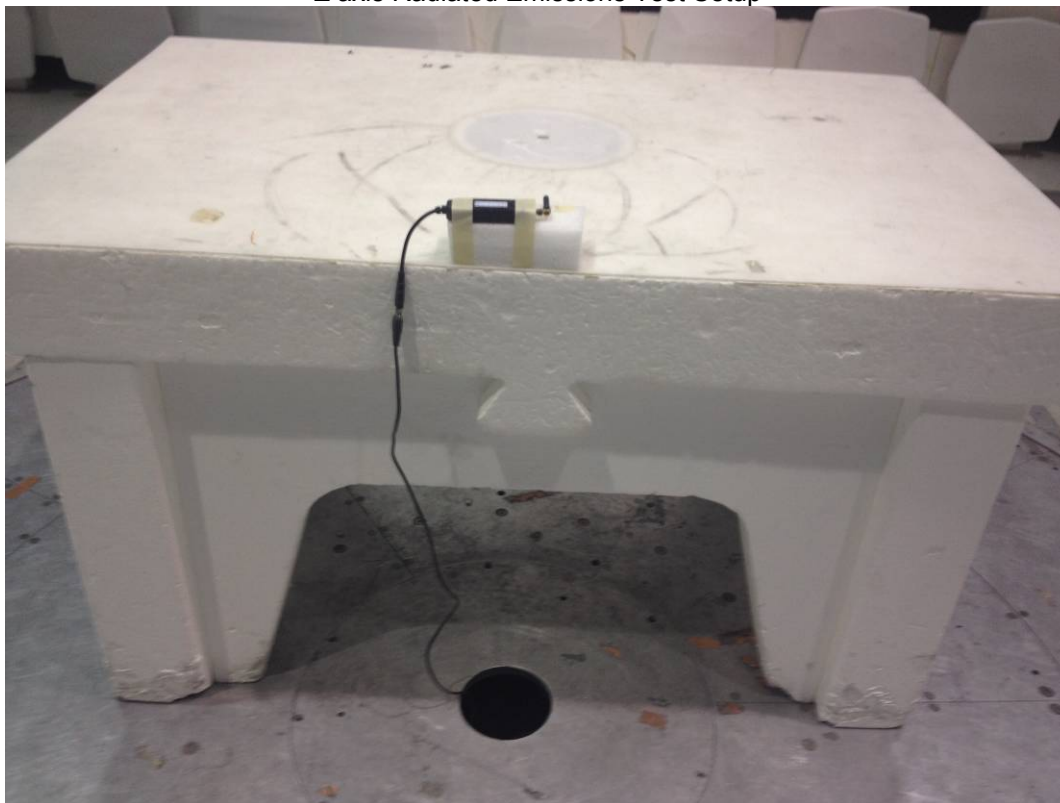
Name	Manufacturer	Version
Excel 2003	Microsoft	(11.8231.8221) SP3
EMI Boxborough.xls	Intertek	08/27/10

6.3 Results:

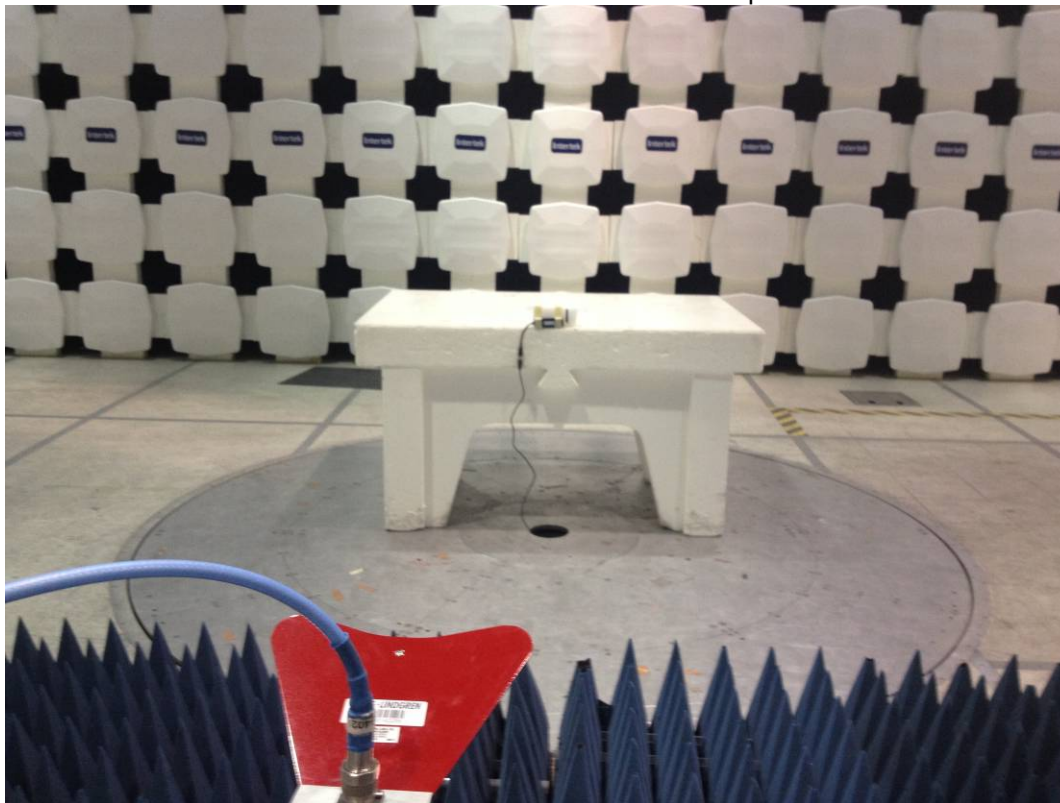
The sample tested was found to comply. The EIRP must not exceed 30 dBm. The Human RF Exposure limit is 1 mW/cm².

6.4 Setup Photographs:

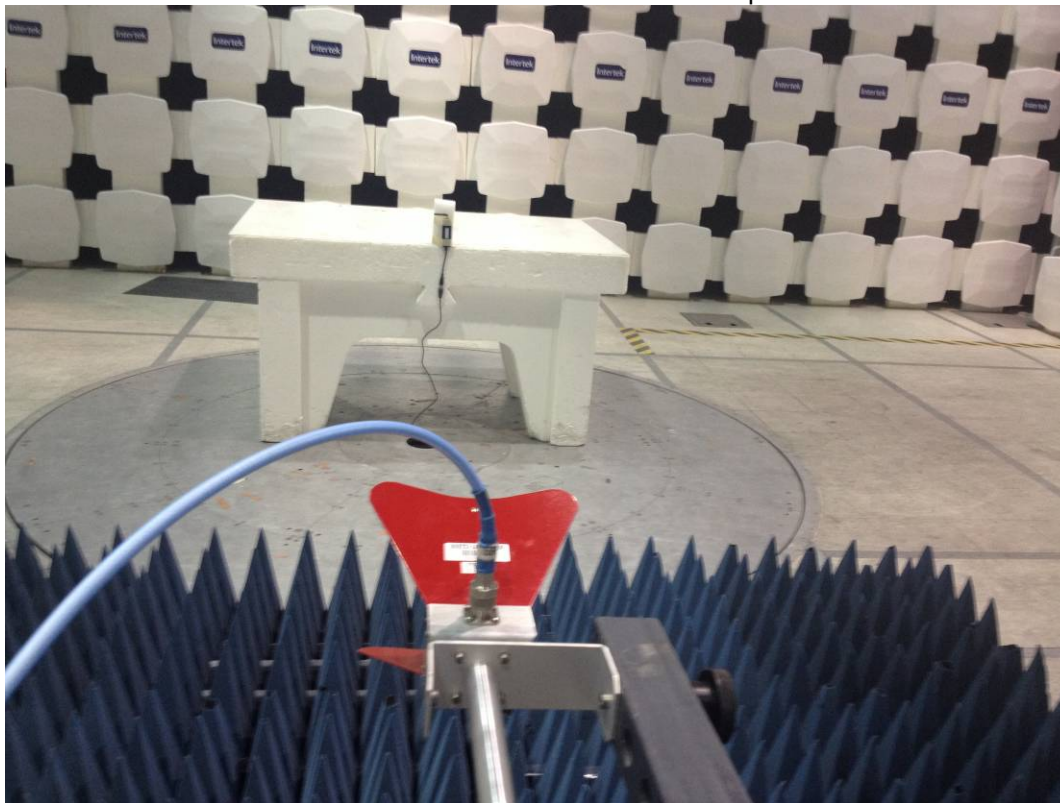
Z axis Radiated Emissions Test Setup



Y axis Radiated Emissions Test Setup



X axis Radiated Emissions Test Setup



Antenna Port Conducted Test Setup



6.5 Test Data:

2465 MHz Fundamental Power Radiated Emissions

Company: QinetiQ North America, Technology
 Model #: PRD-1102196002
 Serial #: Prototype
 Engineers: Kouma Sinn
 Project #: G101602013
 Standard: FCC Part 15 Subpart C 15.247
 Receiver: 145-128
 PreAmp: PRE145014 12-18-2014.txt
 PreAmp Used? (Y or N): N
 Antenna & Cables: LF
 Antenna: ETS001 01-06-15.txt
 Cable(s): 145-416 3mTrkB 10-03-2014.txt
 Bands: N, LF, HF, SHF
 ETS001 01-06-15.txt
 NONE.
 Location: 10m
 Barometer: MAN1
 Filter: NONE
 Date(s): 04/16/14
 Attenuator: None
 Temp/Humidity/Pressure: 19c 34% 1014mbar
 Limit Distance (m): 3
 Test Distance (m): 3
 Voltage/Frequency: Laptop USB Powered
 Frequency Range: Fundamental
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net EIRP (dBm)	Limit EIRP (dBm)	Margin dB	Bandwidth
RF Output											
EIRP was obtained by applying the path loss correction a 3m distance, E(dBuV/m)-95.22 = dBm EIRP											
First Channel Set: Low 2465MHz, Mid 2469MHz & 2467MHz, High 2471MHz											
Low 2465 MHz. X-Axis (EUT sits on cable side) - No attenuator used											
PK	V	2465.000	67.11	32.26	6.03	0.00	0.00	10.19	36.00	-25.81	5/10MHz
PK	H	2465.000	69.71	32.26	6.03	0.00	0.00	12.79	36.00	-23.21	5/10MHz
PK	V	2465.000	67.11	32.26	6.03	0.00	0.00	10.19	36.00	-25.81	1/3MHz
PK	H	2465.000	69.70	32.26	6.03	0.00	0.00	12.78	36.00	-23.22	1/3MHz
Low 2465 MHz. Y-Axis (EUT sits on its long side) - No attenuator used											
PK	V	2465.000	67.62	32.26	6.03	0.00	0.00	10.70	36.00	-25.30	5/10MHz
PK	H	2465.000	66.28	32.26	6.03	0.00	0.00	9.36	36.00	-26.64	5/10MHz
PK	V	2465.000	67.55	32.26	6.03	0.00	0.00	10.63	36.00	-25.37	1/3MHz
PK	H	2465.000	66.22	32.26	6.03	0.00	0.00	9.30	36.00	-26.70	1/3MHz
Low 2465 MHz. Z-Axis flat on its back- No attenuator used											
PK	V	2465.000	64.41	32.26	6.03	0.00	0.00	7.49	36.00	-28.51	5/10MHz
PK	H	2465.000	67.99	32.26	6.03	0.00	0.00	11.07	36.00	-24.93	5/10MHz
PK	V	2465.000	64.27	32.26	6.03	0.00	0.00	7.35	36.00	-28.65	1/3MHz
PK	H	2465.000	67.93	32.26	6.03	0.00	0.00	11.01	36.00	-24.99	1/3MHz

2471 MHz Fundamental Power Radiated Emissions

Company: QinetiQ North America, Technology

Model #: PRD-1102196002

Serial #: Prototype

Engineers: Kouma Sinn

Project #: G101602013

Standard: FCC Part 15 Subpart C 15.247

Receiver: 145-128

PreAmp: PRE145014 12-18-2014.txt

PreAmp Used? (Y or N): N

Limit Distance (m): 3

Test Distance (m): 3

Voltage/Frequency: Laptop USB Powered

Frequency Range: Fundamental

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Antenna & Cables: LF

Bands: N, LF, HF, SHF

Antenna: ETS001 01-06-15.txt

ETS001 01-06-15.txt

Cable(s): 145-416 3mTrkB 10-03-2014.txt

NONE.

Barometer: MAN1

Filter: NONE

Attenuator: None

Temp/Humidity/Pressure: 19c

34% 1014mbar

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net EIRP (dBm)	Limit EIRP (dBm)	Margin dB	Bandwidth
RF Output											
EIRP was obtained by applying the path loss correction a 3m distance, E(dBuV/m)-95.22 = dBm EIRP											
First Channel Set: Low 2465MHz, Mid 2469MHz & 2467MHz, High 2471MHz											
Upper 2471 MHz. X-Axis (EUT sits on cable side) - No attenuator used											
PK	V	2471.000	65.28	32.28	6.04	0.00	0.00	8.38	36.00	-27.62	5/10MHz
PK	H	2471.000	69.31	32.28	6.04	0.00	0.00	12.41	36.00	-23.59	5/10MHz
PK	V	2471.000	65.21	32.28	6.04	0.00	0.00	8.31	36.00	-27.69	1/3MHz
PK	H	2471.000	69.31	32.28	6.04	0.00	0.00	12.41	36.00	-23.59	1/3MHz
Upper 2471 MHz. Y-Axis (EUT sits on its long side) - No attenuator used											
PK	V	2471.000	65.92	32.28	6.04	0.00	0.00	9.02	36.00	-26.98	5/10MHz
PK	H	2471.000	65.40	32.28	6.04	0.00	0.00	8.50	36.00	-27.50	5/10MHz
PK	V	2471.000	65.79	32.28	6.04	0.00	0.00	8.89	36.00	-27.11	1/3MHz
PK	H	2471.000	65.27	32.28	6.04	0.00	0.00	8.37	36.00	-27.63	1/3MHz
Upper 2471 MHz. Z-Axis flat on its back - No attenuator used											
PK	V	2471.000	66.64	32.28	6.04	0.00	0.00	9.74	36.00	-26.26	5/10MHz
PK	H	2471.000	69.71	32.28	6.04	0.00	0.00	12.81	36.00	-23.19	5/10MHz
PK	V	2471.000	66.40	32.28	6.04	0.00	0.00	9.50	36.00	-26.50	1/3MHz
PK	H	2471.000	69.66	32.28	6.04	0.00	0.00	12.76	36.00	-23.24	1/3MHz

2473 MHz Fundamental Power Radiated Emissions

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/16/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 19C 32% 1016mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): N Voltage/Frequency: Laptop USB Powered Frequency Range: Fundamental
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

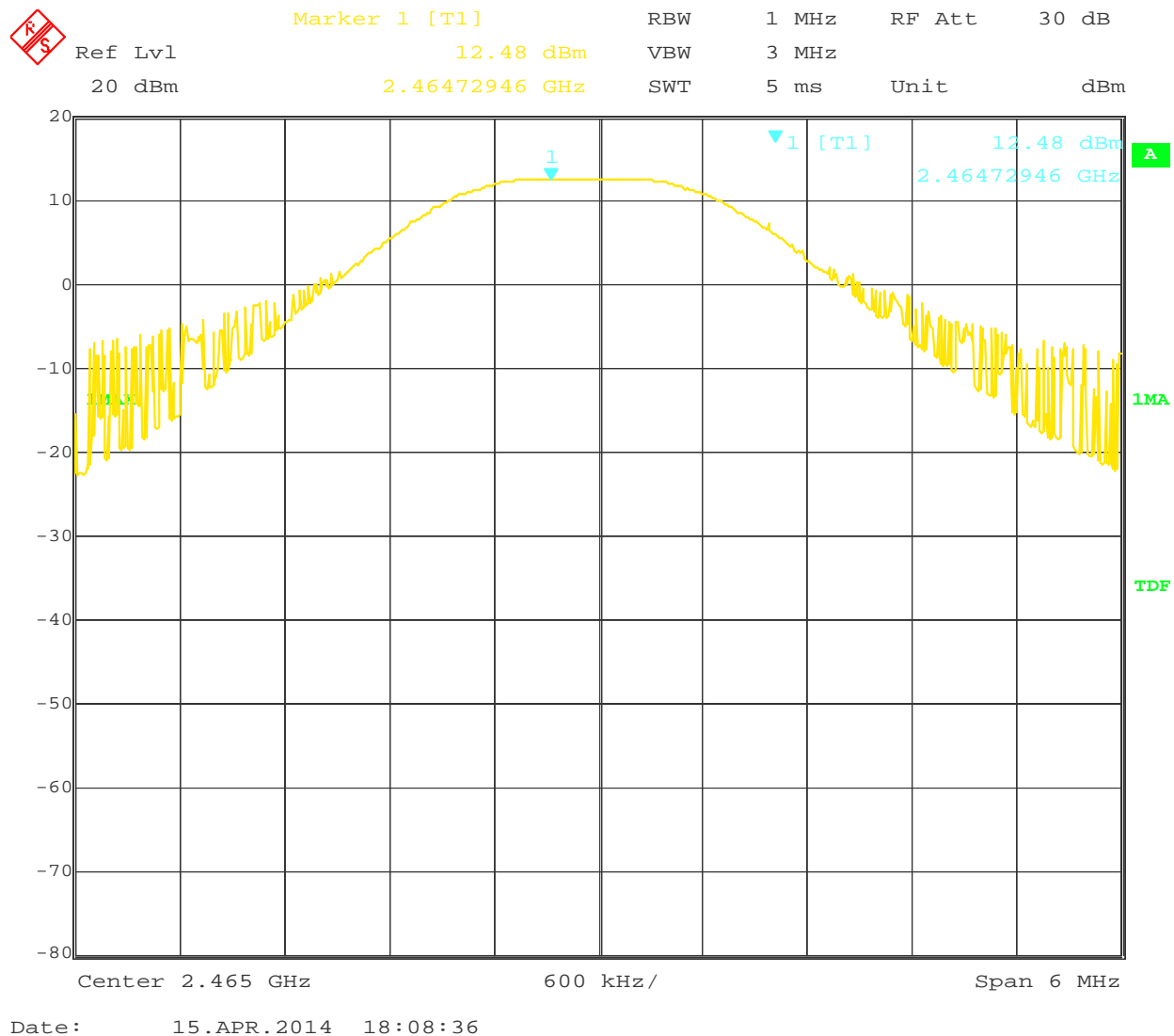
Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net EIRP (dBm)	Limit EIRP (dBm)	Margin dB	Bandwidth
RF Output											
EIRP was obtained by applying the path loss correction a 3m distance, E(dBuV/m)-95.22 = dBm EIRP											
First Channel Set: Low 2473MHz, Mid 2475MHz & 2477MHz, High 2479MHz											
X-Axis (EUT sits on cable side) - No attenuator used											
PK	V	2473.000	64.41	32.28	6.05	0.00	0.00	7.52	36.00	-28.48	5/10MHz
PK	H	2473.000	68.22	32.28	6.05	0.00	0.00	11.33	36.00	-24.67	5/10MHz
PK	V	2473.000	64.34	32.28	6.05	0.00	0.00	7.45	36.00	-28.55	1/3MHz
PK	H	2473.000	68.20	32.28	6.05	0.00	0.00	11.31	36.00	-24.69	1/3MHz
Y-Axis (EUT sits on its long side) - No attenuator used											
PK	V	2473.000	68.10	32.28	6.05	0.00	0.00	11.21	36.00	-24.79	5/10MHz
PK	H	2473.000	65.04	32.28	6.05	0.00	0.00	8.15	36.00	-27.85	5/10MHz
PK	V	2473.000	68.03	32.28	6.05	0.00	0.00	11.14	36.00	-24.86	1/3MHz
PK	H	2473.000	64.93	32.28	6.05	0.00	0.00	8.04	36.00	-27.96	1/3MHz
Z-Axis(EUT sits flat)- No attenuator used											
PK	V	2473.000	60.19	32.28	6.05	0.00	0.00	3.30	36.00	-32.70	5/10MHz
PK	H	2473.000	70.39	32.28	6.05	0.00	0.00	13.50	36.00	-22.50	5/10MHz
PK	V	2473.000	59.78	32.28	6.05	0.00	0.00	2.89	36.00	-33.11	1/3MHz
PK	H	2473.000	70.37	32.28	6.05	0.00	0.00	13.48	36.00	-22.52	1/3MHz

2479 MHz Fundamental Power Radiated Emissions

Company: QinetiQ North America, Technology	Antenna & Cables: LF	Bands: N, LF, HF, SHF
Model #: PRD-1102196002	Antenna: ETS001 01-06-15.txt	ETS001 01-06-15.txt
Serial #: Prototype	Cable(s): 145-416 3mTrkB 10-03-2014.txt	NONE.
Engineers: Kouma Sinn	Location: 10m	Barometer: MAN1
Project #: G101602013	Date(s): 04/17/14	Filter: NONE
Standard: FCC Part 15 Subpart C 15.247	Temp/Humidity/Pressure: 21C	23% 1031mbar
Receiver: 145-128	Limit Distance (m): 3	
PreAmp: PRE145014 12-18-2014.txt	Test Distance (m): 3	
PreAmp Used? (Y or N): N	Voltage/Frequency: Laptop USB Powered	Frequency Range: Fundamental
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)		
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW		

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net EIRP (dBm)	Limit EIRP (dBm)	Margin dB	Bandwidth
EIRP was obtained by applying the path loss correction a 3m distance, E(dBuV/m)-95.22 = dBm EIRP											
First Channel Set: Low 2473MHz, Mid 2475MHz & 2477MHz, High 2479MHz											
X-Axis (EUT sits on cable side) - No attenuator used											
PK	V	2479.000	64.24	32.30	6.06	0.00	0.00	7.38	36.00	-28.62	5/10MHz
PK	H	2479.000	69.71	32.30	6.06	0.00	0.00	12.85	36.00	-23.15	5/10MHz
PK	V	2479.000	63.99	32.30	6.06	0.00	0.00	7.13	36.00	-28.87	1/3MHz
PK	H	2479.000	69.46	32.30	6.06	0.00	0.00	12.60	36.00	-23.40	1/3MHz
Y-Axis (EUT sits on its long side) - No attenuator used											
PK	V	2479.000	66.53	32.30	6.06	0.00	0.00	9.67	36.00	-26.33	5/10MHz
PK	H	2479.000	65.28	32.30	6.06	0.00	0.00	8.42	36.00	-27.58	5/10MHz
PK	V	2479.000	66.28	32.30	6.06	0.00	0.00	9.42	36.00	-26.58	1/3MHz
PK	H	2479.000	65.10	32.30	6.06	0.00	0.00	8.24	36.00	-27.76	1/3MHz
Z-Axis(EUT sits flat) - No attenuator used											
PK	V	2479.000	64.54	32.30	6.06	0.00	0.00	7.68	36.00	-28.32	5/10MHz
PK	H	2479.000	68.22	32.30	6.06	0.00	0.00	11.36	36.00	-24.64	5/10MHz
PK	V	2479.000	64.21	32.30	6.06	0.00	0.00	7.35	36.00	-28.65	1/3MHz
PK	H	2479.000	68.09	32.30	6.06	0.00	0.00	11.23	36.00	-24.77	1/3MHz

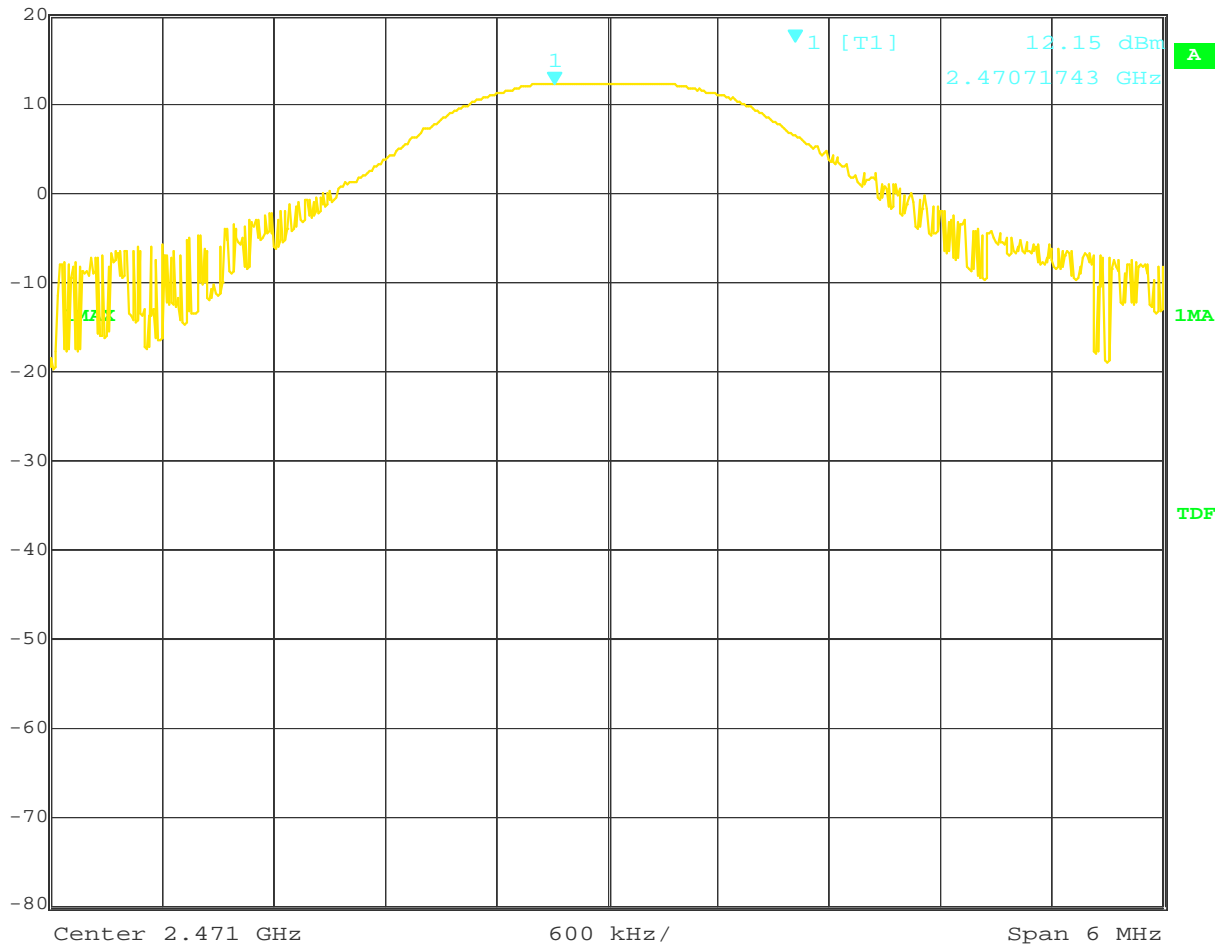
2465 MHz Antenna Port Conducted Power (12.48 dBm)



2471 MHz Antenna Port Conducted Power (12.15 dBm)



Marker 1 [T1] RBW 1 MHz RF Att 30 dB
 12.15 dBm VBW 3 MHz
 20 dBm 2.47071743 GHz SWT 5 ms Unit dBm

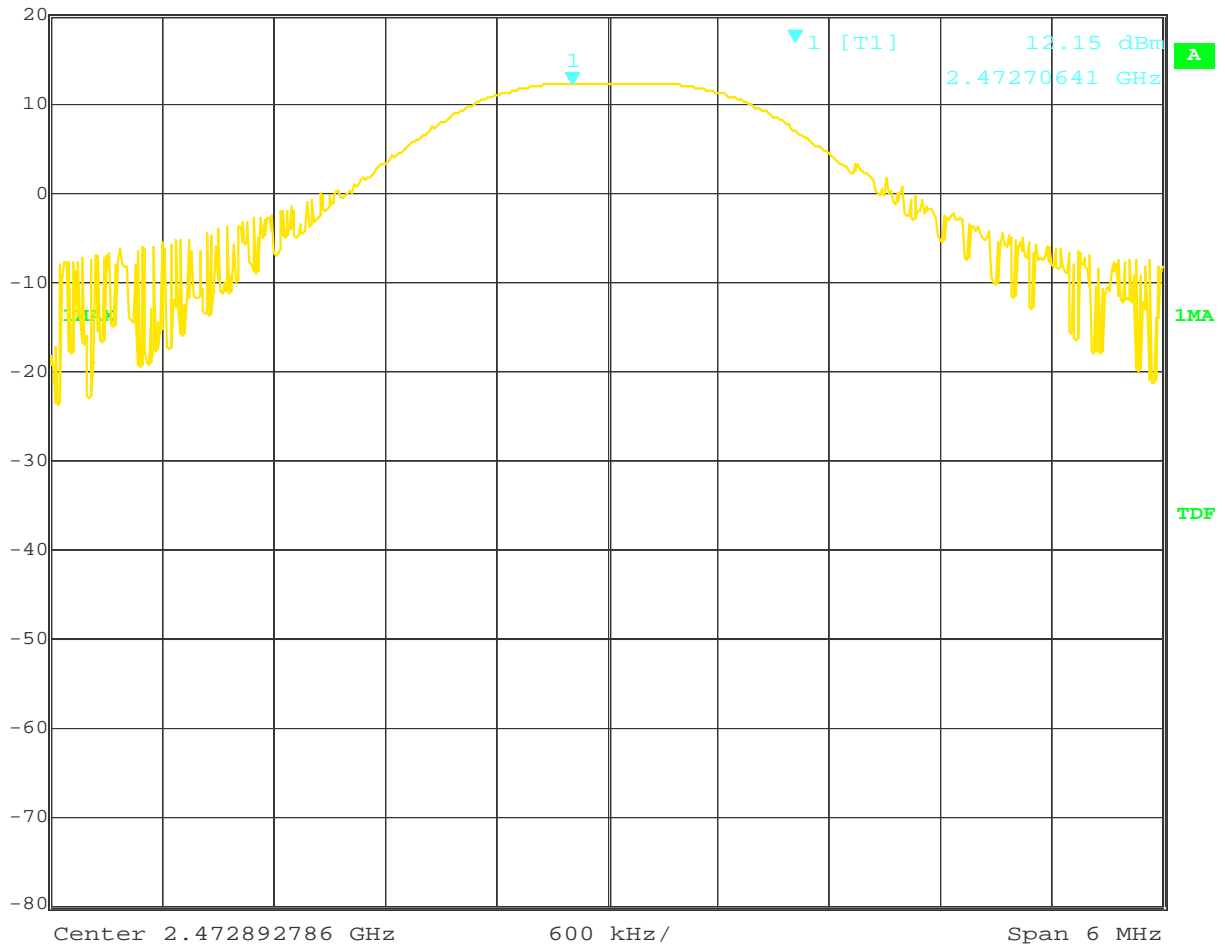


Date: 15.APR.2014 18:26:54

2473 MHz Antenna Port Conducted Power (12.15 dBm)\



Marker 1 [T1] RBW 1 MHz RF Att 30 dB
 Ref Lvl 12.15 dBm VBW 3 MHz
 20 dBm 2.47270641 GHz SWT 5 ms Unit dBm

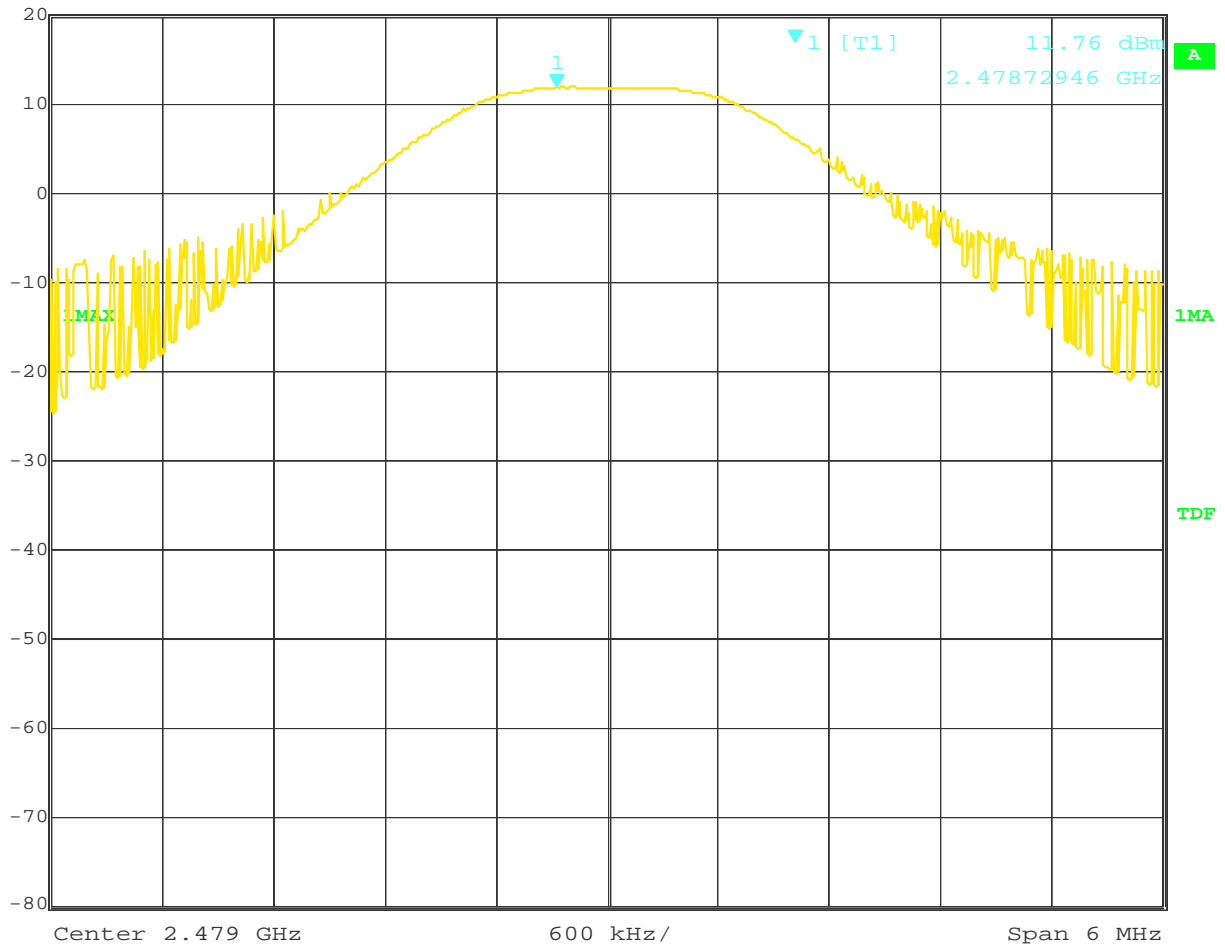


Date: 15.APR.2014 17:40:28

2479 MHz Antenna Port Conducted Power (11.76 dBm)



Marker 1 [T1] RBW 1 MHz RF Att 30 dB
 Ref Lvl 11.76 dBm VBW 3 MHz
 20 dBm 2.47872946 GHz SWT 5 ms Unit dBm



Date: 15.APR.2014 17:59:05

Fundamental Power Summary:

Frequency (MHz)	Radiated EIRP (dBm)	Conducted EIRP (dBm)	Res/Video BW (MHz)
2465	12.78	12.48	1/3
2471	12.81	12.15	1/3
2473	13.50	12.15	1/3
2479	12.60	11.76	1/3

Test Personnel: Kouma Sinn *KPS*
Supervising/Reviewing
Engineer:
(Where Applicable) N/A

Test Date: 04/15/2014, 04/16/2014

Product Standard: FCC Part 15.247,
RSS-210 Annex 8
Input Voltage: USB Powered
Pretest Verification w/
Ambient Signals or
BB Source: Ambient Signals

Limit Applied: Emissions below the limits
specified in Section 6.3

Ambient Temperature: 21, 19 °C

Relative Humidity: 56, 34 %

Atmospheric Pressure: 1000, 1014 mbars

Deviations, Additions, or Exclusions: None

The EUT was measured in a radiated fashion. The RF output power was measured using a resolution bandwidth which encompassed the entire emission bandwidth. The data obtained was adjusted for equipment losses and converted from a field strength reading to a power reading using the provisions of FCC KDB 558074 and RSS-Gen 4.6. The human RF exposure limit is 1 mW/cm². The power density S generated by some value of EIRP at a given distance d is related by the equation:

$$S = \text{EIRP} / (4\pi d^2)$$

The distance, given a maximum EIRP of 13.5 dBm (22.387 mW), at which the radiated power density of the EUT is equal to the human RF exposure limit is 1.335 cm from the antenna. This result does not take averaging into account. The EUT is exempt from FCC SAR RF Exposure evaluation because the output power is below the KDB 447498 exemption threshold:

Peak power at 2473 MHz = 13.5dBm. With a very conservative tune-up tolerance of no more than +/- 2dB, we'll call it 15.5 dBm to account for the worst case variation in production units. To get the average power, we multiply the worst case peak power by the duty cycle. With the duty cycle measured of 20.24%, the average power is calculated as follow:

15.5dBm = 35.48mW peak @ 2473 MHz.

35.48mW*0.2024 duty cycle = 7.181 mW.

From section 4.3.1 of KDB 447498 for the SAR exclusion test 1 (for distances < 50mm)

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot$

$[\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz (our worst case is 2.473 GHz)
- Power and distance are rounded to the nearest mW and mm before calculation (Power is rounded up extremely conservatively from 7.181 mW to 8 mW, and distance is the worst case 5mm)
- The result is rounded to one decimal place for comparison.

$$[8\text{mW}/5\text{mm}] \cdot [\sqrt{2.473\text{GHz}}] = [1.6] \cdot [1.57] = 2.516.$$

Again, we'll round up conservatively to 2.6 per the last bullet to round to the nearest one decimal place.

So $2.6 \leq 3$ and $2.6 \leq 7.5$:

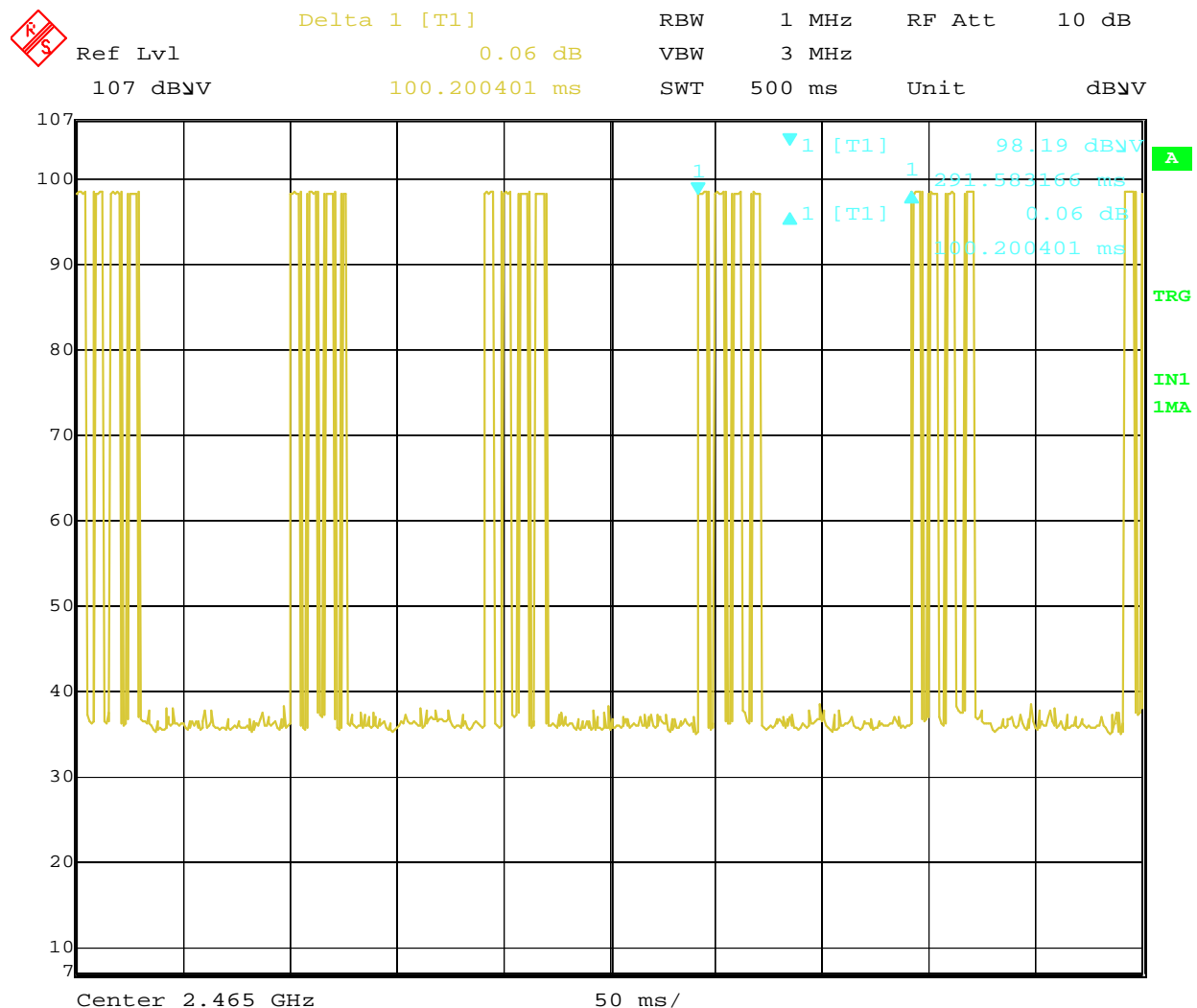
This satisfies both the ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR exemption criteria.

The EUT is exempt from Industry Canada SAR RF Exposure evaluation as referenced in RSS-102 because the operating frequency is between 2.2 and 3.0 GHz and the EIRP does not exceed 20 milliwatts.

A duty cycle averaging factor has been calculated which takes into account the typical EUT duty cycle. The burst on time is 20.24ms, the duty cycle can be calculated using the equation $\text{dB reduction} = 20 \cdot \text{Log}(\text{on-time} / \text{burst interval})$ or $20 \cdot \text{Log}(20.24/100)$, and the duty cycle average factor obtained is 13.9 dB.

Duty Cycle:

The worst-case duty cycle for typical EUT operation is shown below. The pulse train repeats over a larger than 100ms period.

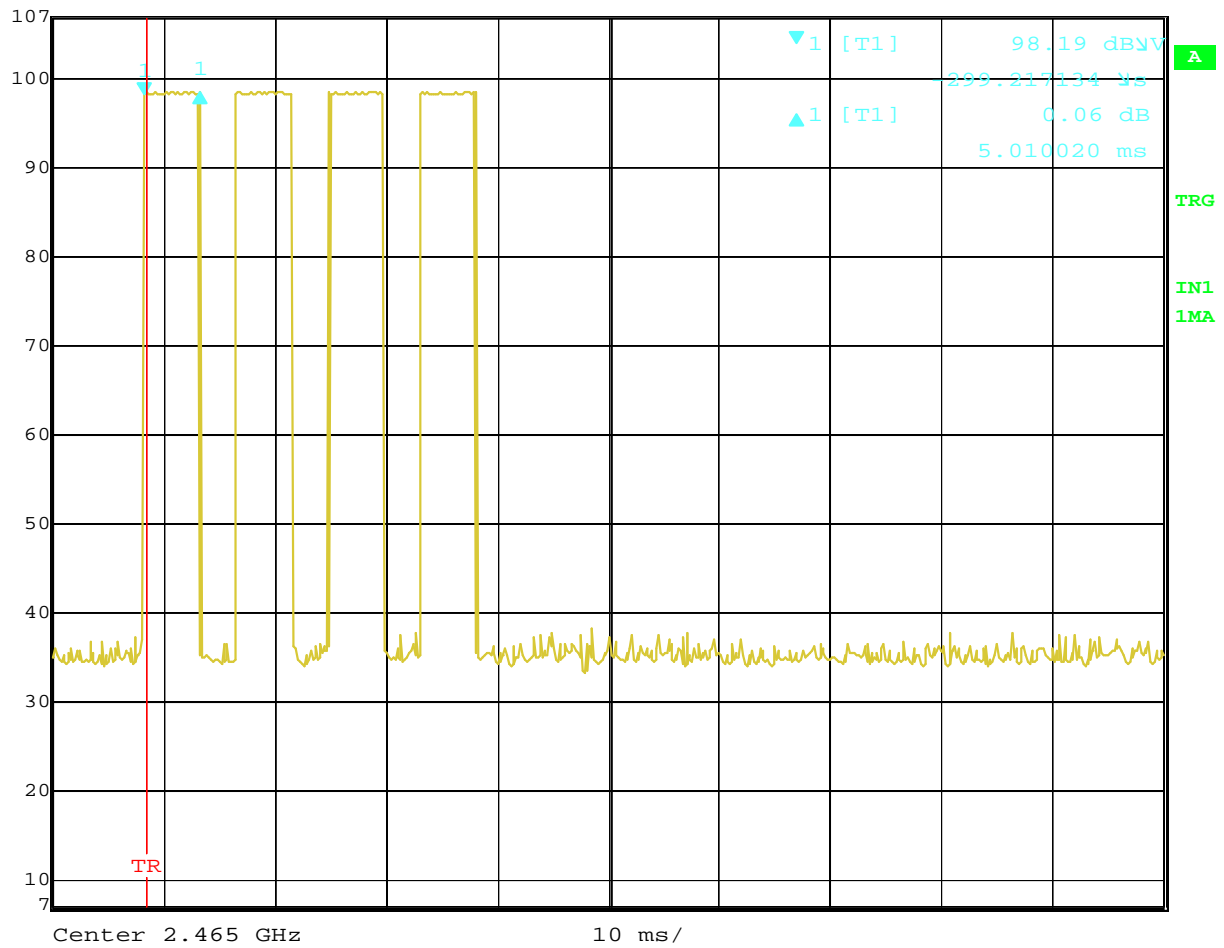


Date: 17.MAY.2014 16:28:06

t on 1



	Delta 1 [T1]	RBW	1 MHz	RF Att	10 dB
Ref Lvl	0.06 dB	VBW	3 MHz		
107 dBμV	5.010020 ms	SWT	100 ms	Unit	dBμV



Date: 17.MAY.2014 16:40:59



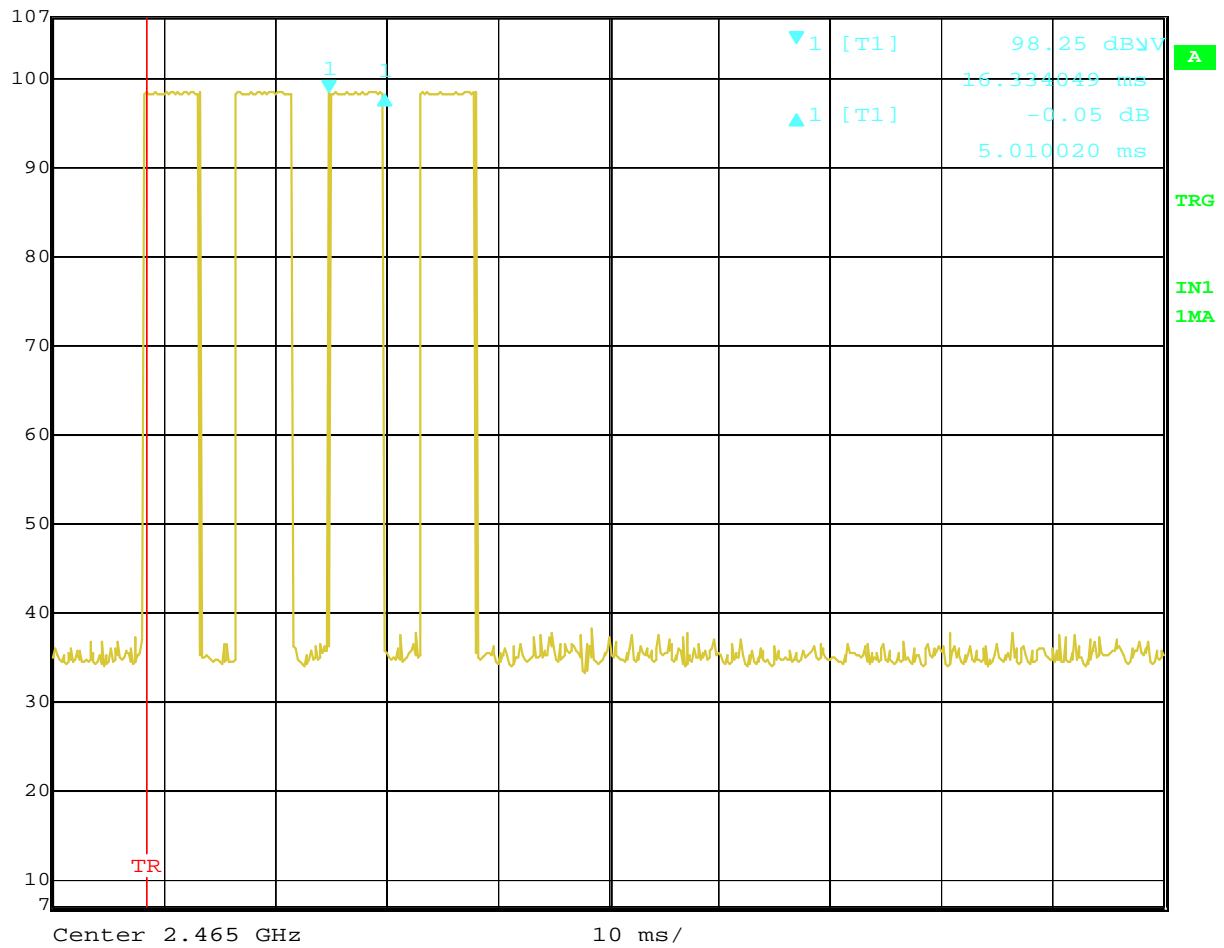
dBV



t on 3



Ref Lvl	Delta 1 [T1]	RBW	1 MHz	RF Att	10 dB
107 dBμV	-0.05 dB	VBW	3 MHz		
	5.010020 ms	SWT	100 ms	Unit	dBμV

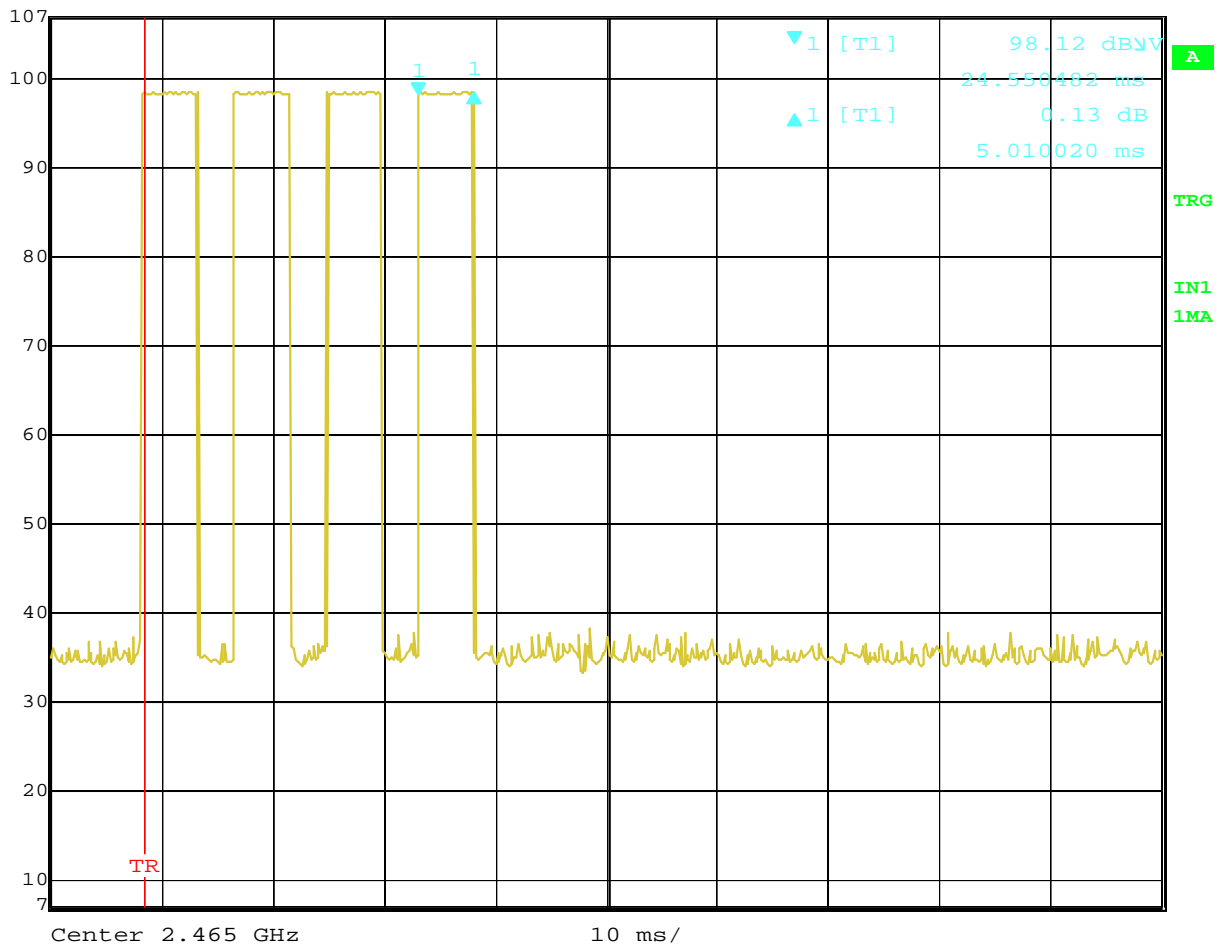


Date: 17.MAY.2014 16:44:59

t on 4



Delta 1 [T1] RBW 1 MHz RF Att 10 dB
 Ref Lvl 0.13 dB VBW 3 MHz
 107 dBμV 5.010020 ms SWT 100 ms Unit dBμV



Date: 17.MAY.2014 16:46:13

t on 1 = 5.01002
 t on 2 = 5.210421
 t on 3 = 5.01002
 t on 4 = 5.01002
 Total t on = 20.240481
 Duty Cycle = 20.24048/100 0.20240481
 AVG Factor = 20*log(0.20240) -13.87558342

Test Personnel: Kouma Sinn *KPS*
Supervising/Reviewing Engineer:
(Where Applicable) N/A
Product Standard: FCC Part 15.247,
RSS-210 Annex 8
Input Voltage: USB Powered
Pretest Verification w/
Ambient Signals or
BB Source: BB Source

Test Date: 05/17/2014
Limit Applied: Emissions below the limits
specified in Section 6.3
Ambient Temperature: 23 °C
Relative Humidity: 48 %
Atmospheric Pressure: 1004 mbars

Deviations, Additions, or Exclusions: None

7 Transmitter Radiated Spurious Emissions

7.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.4:2009, and RSS-210 Annex 8.

TEST SITE: EMC Lab & 10m ALSE

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A wooden table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) $< U_{CISPR}$ (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dB μ V/m

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB μ V

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$
$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	01/06/2014	01/06/2015
145-416'	Cables 145-400 145-402 145-404 145-408	Huber + Suhner	3m Track B cables	multiple	10/04/2013	10/04/2014
MAN1'	Digital 4 Line Barometer	Mannix	0ABA116	MAN1	08/13/2012	08/13/2014
145128'	EMI Receiver (20 Hz - 40 GHz)	Rohde & Schwarz	ESIB 40	839283/001	03/17/2014	03/17/2015
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	12/19/2013	12/19/2014
REA004'	3GHz High Pass Filter	Reactel, Inc	7HSX-3G/18G-S11	06-1	12/30/2013	12/30/2015
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	03/20/2014	03/20/2015
EMC04'	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	03/31/2014	03/31/2015
REA006'	18GHz High Pass Filter	Reactel, Inc	7HS-18G/40G K11	(06)1	08/08/2012	08/08/2014
PRE9'	100MHz-40GHz Preamp	MITEQ	NSP4000-NFG	1260417	09/06/2013	09/06/2014
CBL030'	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	04/05/2014	04/05/2015
ROS001'	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	04/25/2013	05/02/2014
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61A	09/25/2012	09/25/2014
145-410'	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	10/04/2013	10/04/2014
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	10/01/2013	10/01/2014
145003'	Preamplifier (150 KHz to 1.3 GHz)	Hewlett Packard	8447D	2443A04077	10/07/2013	10/07/2014
CBLHF2012 -2M-1'	2m 40GHz Coaxial Cable	Huber & Suhner	SF102	252675001	01/14/2014	01/14/2015
ROS001	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	04/25/2013	05/02/2014
CBLHF2012 -2M-2'	2m 40GHz Coaxial Cable	Huber & Suhner	SF102	252675002	01/14/2014	01/14/2015

Software Utilized:

Name	Manufacturer	Version
C5 Emissions	TESEQ	5.26.46.46
EMI Boxborough.xls	Intertek	08/27/2010

7.3 Results:

The sample tested was found to Comply.

FCC Part 15.247(d) & RSS-210 A8.5 – Non Restricted Band Radiated Spurious/Harmonics Limits

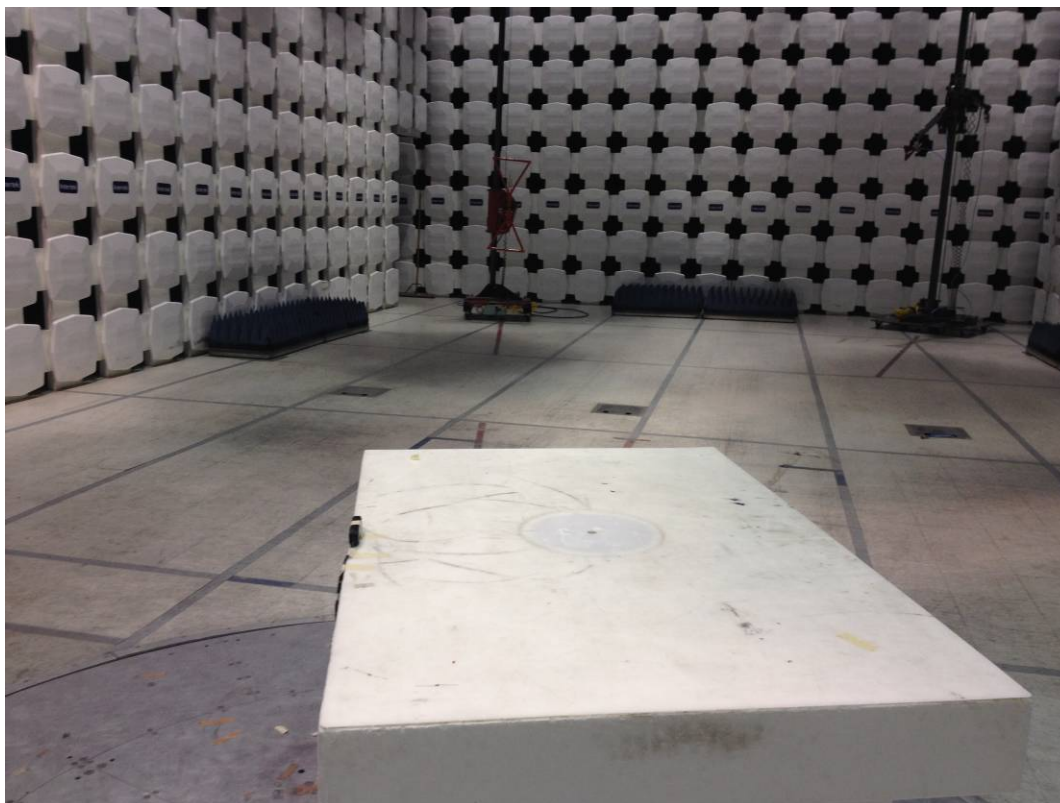
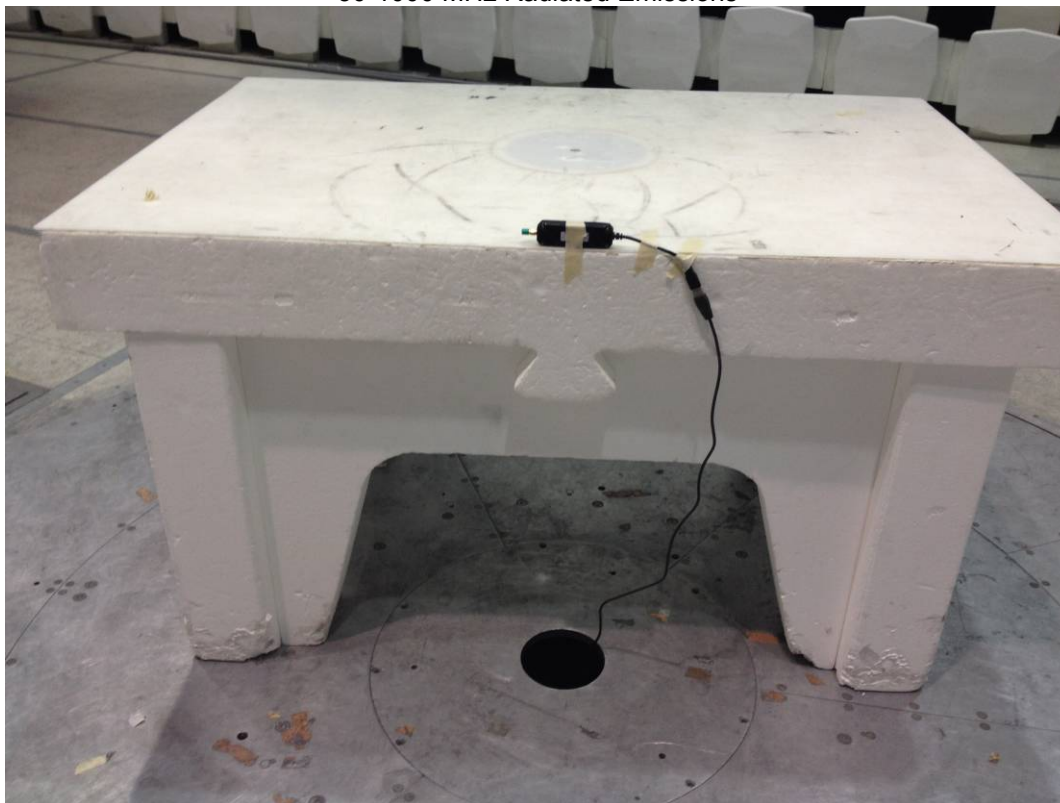
In any 100 kHz bandwidth outside the frequency band, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) and RSS-Gen Section 7.2.5 Table 5 is not required. In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a) and RSS-Gen Section 7.2.2 Table 3, must also comply with the radiated emission limits specified in 15.209(a) and IC RSS-Gen Section 7.2.5 Table 5).

FCC Part 15.209(a) & RSS-210 A8.5 & RSS-Gen Section 7.2.5 Table 5 – Restricted Band Radiated Spurious/Harmonics Limits

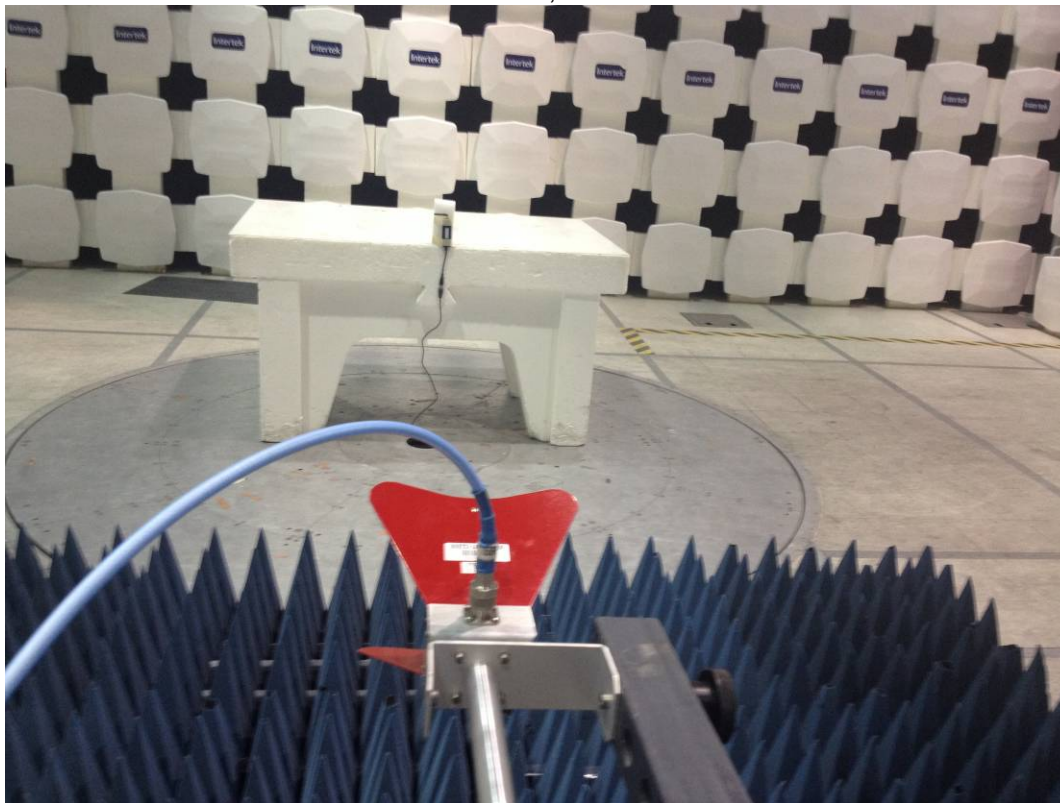
Frequency (MHz)	Field Strength		Test Distance (meters)
	μV/m	dBμV/m	
30–88	100	40.00	3
88–216	150	43.52	3
216–960	200	46.02	3
Above 960	500	53.98	3

7.4 Setup Photographs:

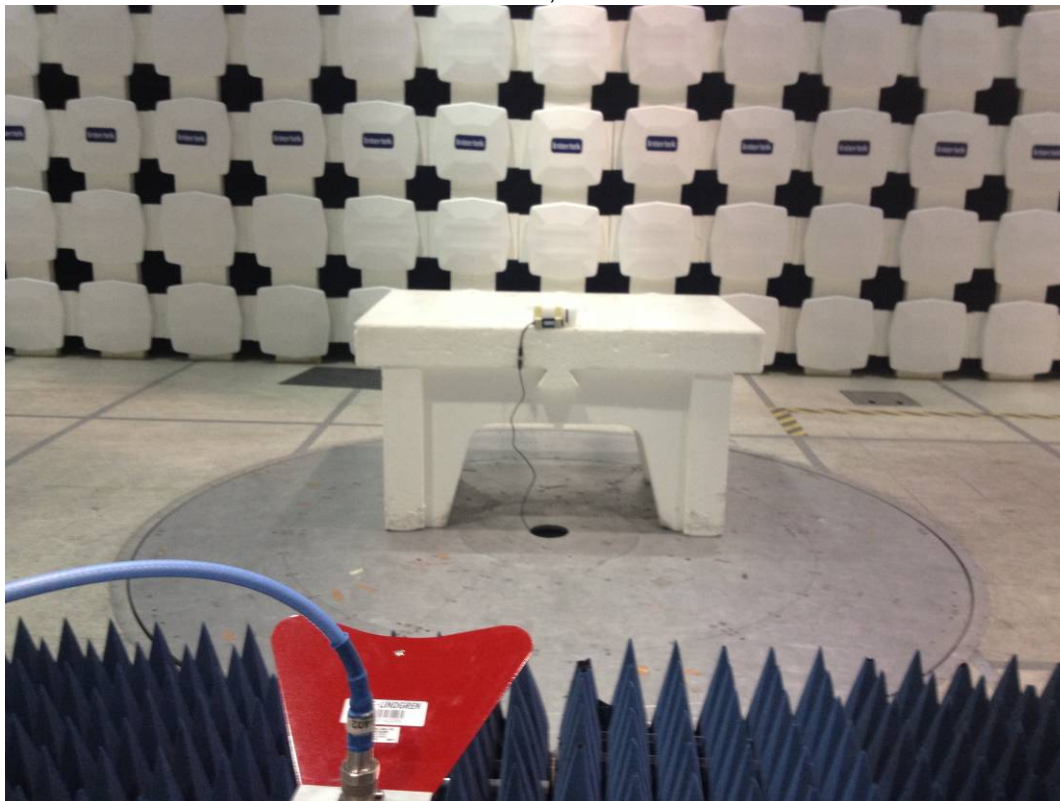
30-1000 MHz Radiated Emissions



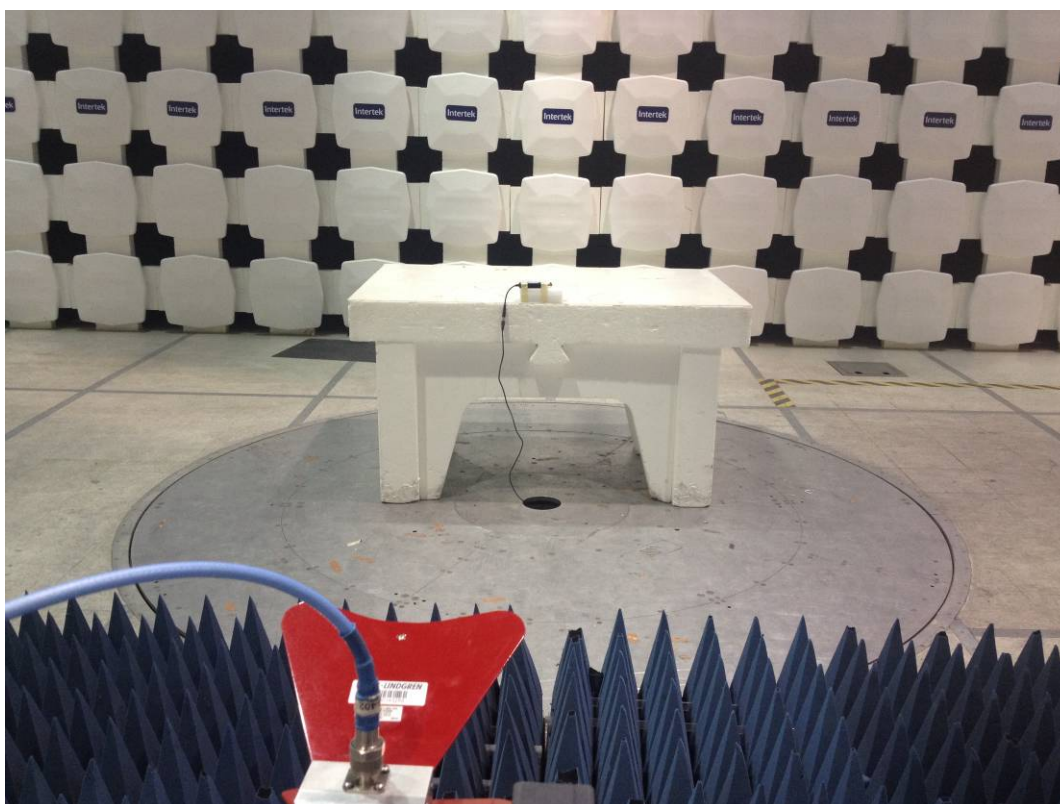
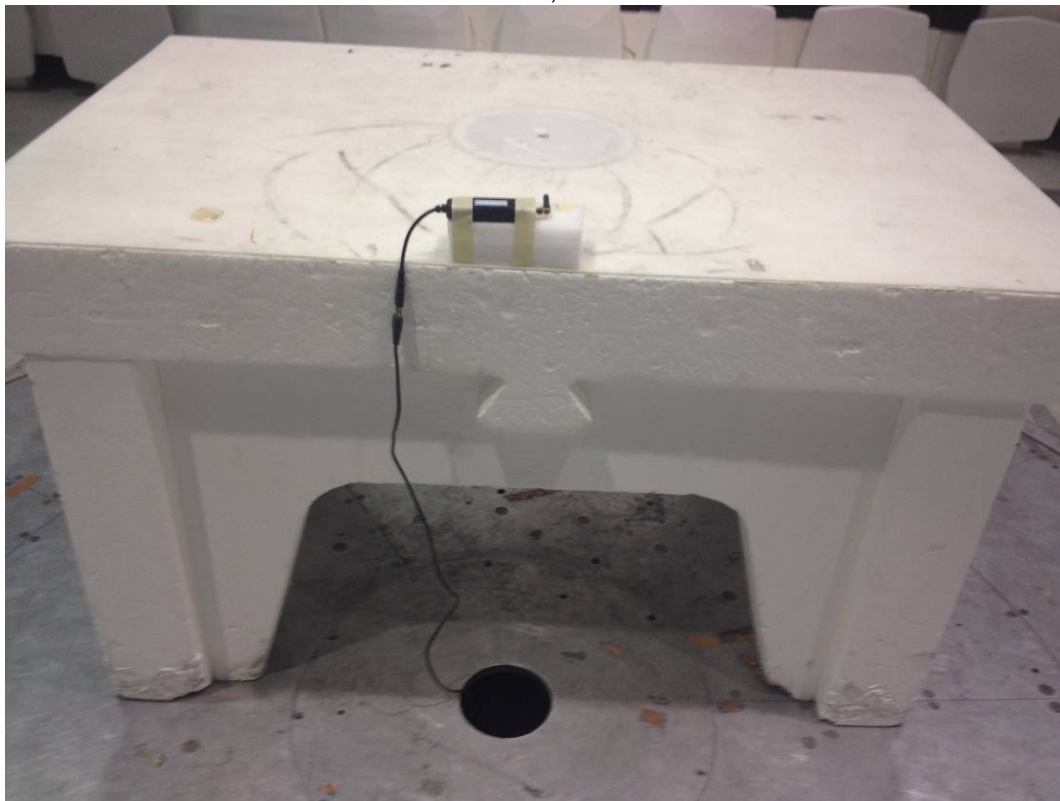
1-15 GHz, X-Axis



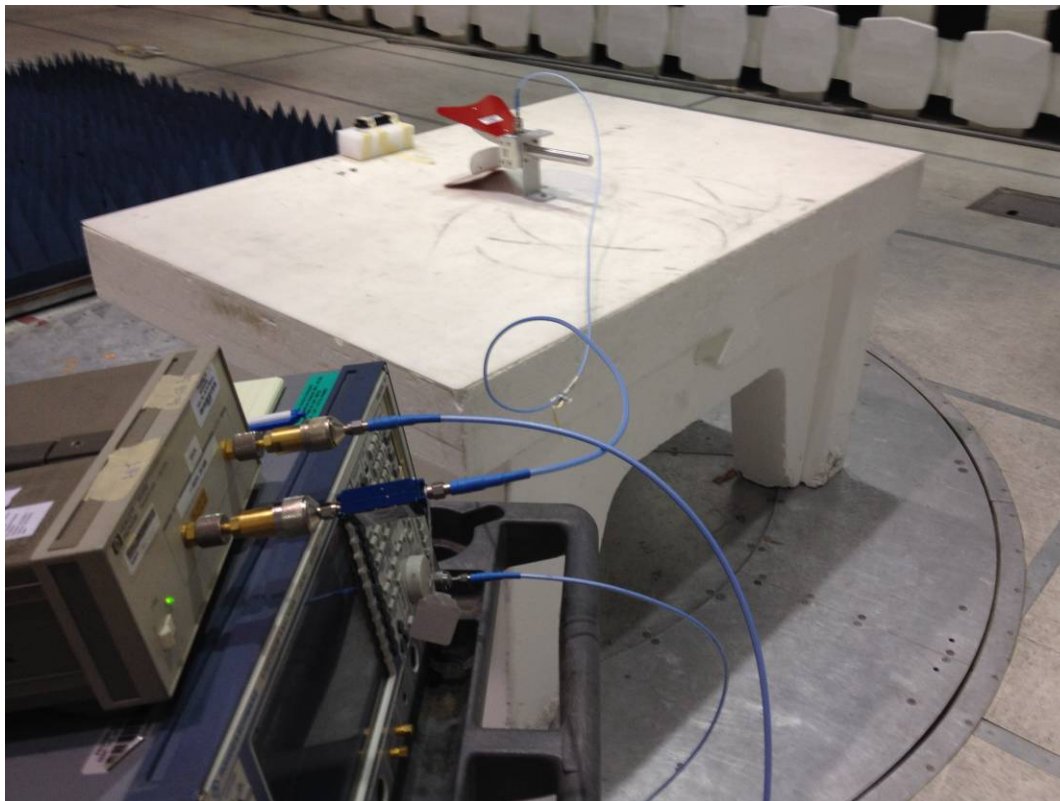
1-15 GHz, Y-Axis



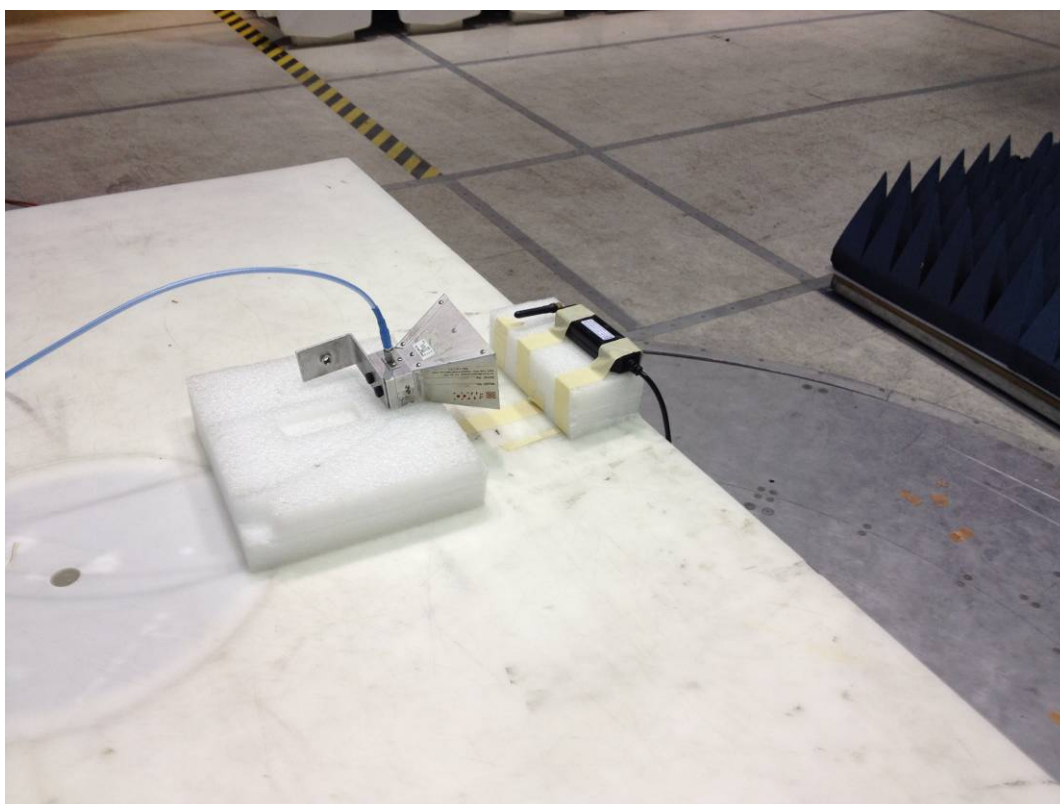
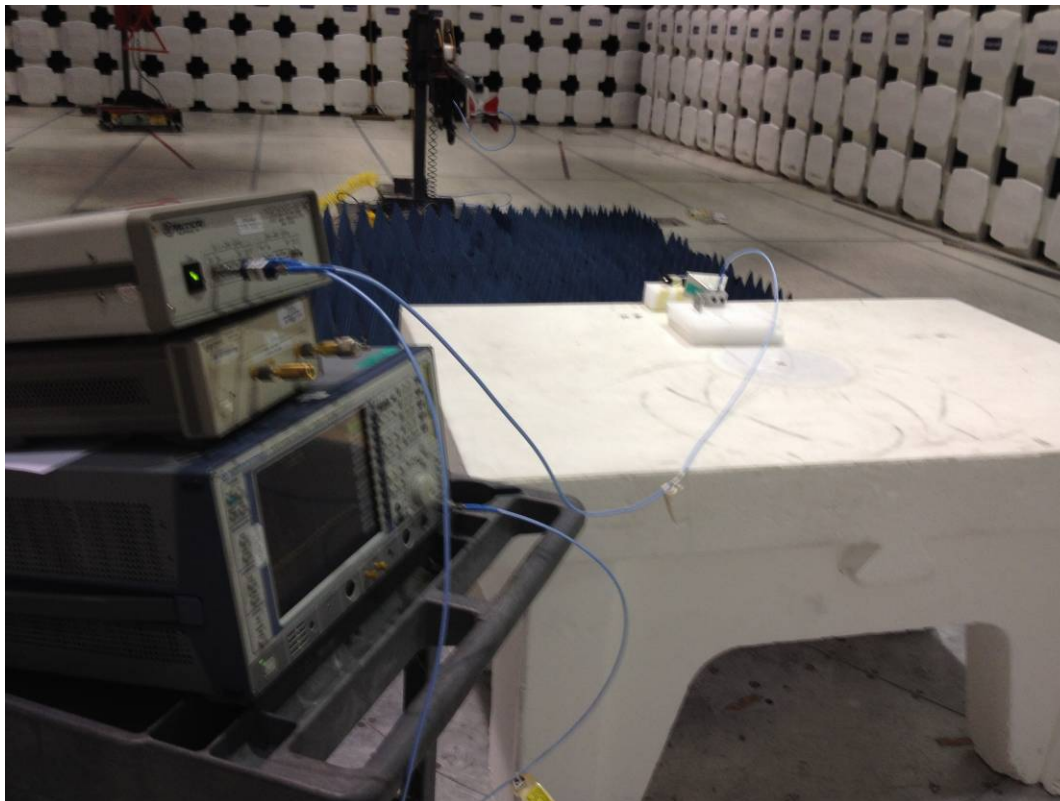
1-15 GHz, Z-Axis



Hand Scan 15-18 GHz



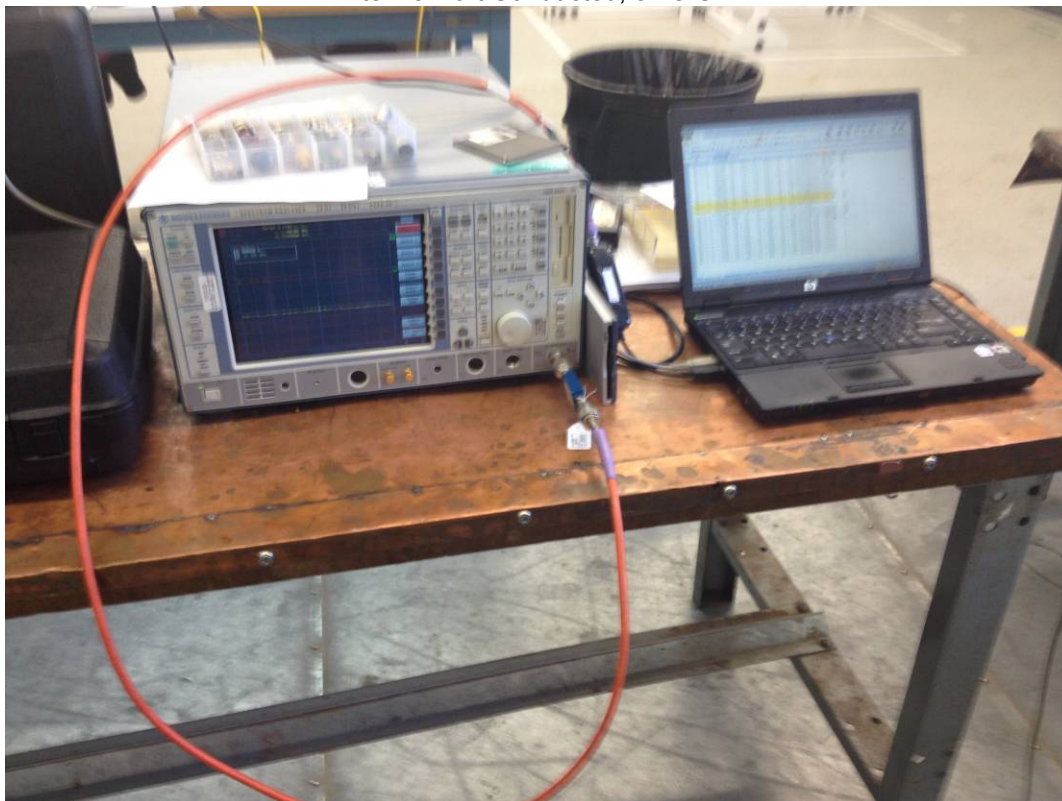
Hand Scan 18-25 GHz



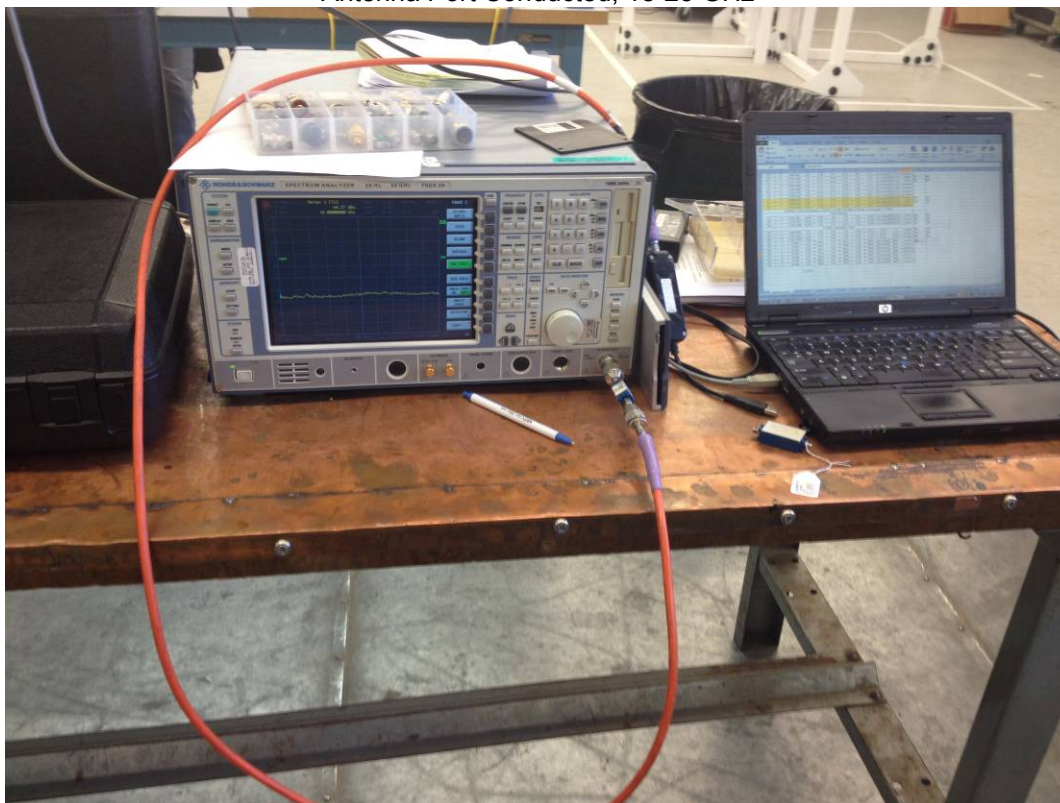
Antenna Port Conducted, 30MHz-3GHz



Antenna Port Conducted, 3-18 GHz



Antenna Port Conducted, 18-25 GHz



7.5 Plots/Data:

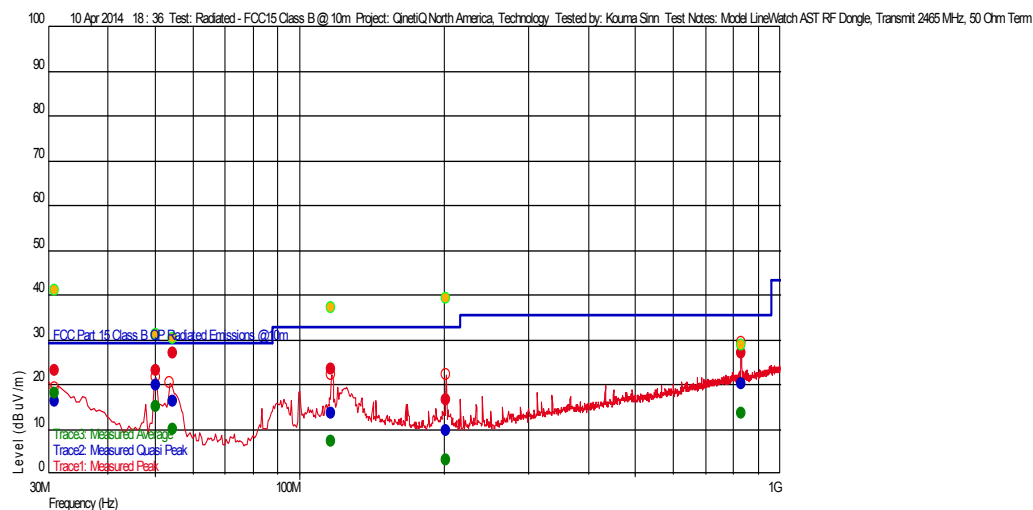
Transmits 2465 MHz, 50 Ohm Terminator (30-1000 MHz)

Test Information

Test Details User Entry
 Test: Radiated - FCC15 Class B @ 10m
 Project: QinetiQ North America, Technology
 Test Notes: Model PRD-1102196002, Transmit 2465 MHz, 50 Ohm Term
 Temperature: 22C
 Humidity: 23%, 1007mbar
 Tested by: Kouma Sinn
 Test Started: 10 Apr 2014 18 : 36

Additional Information

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace1: Measured Peak

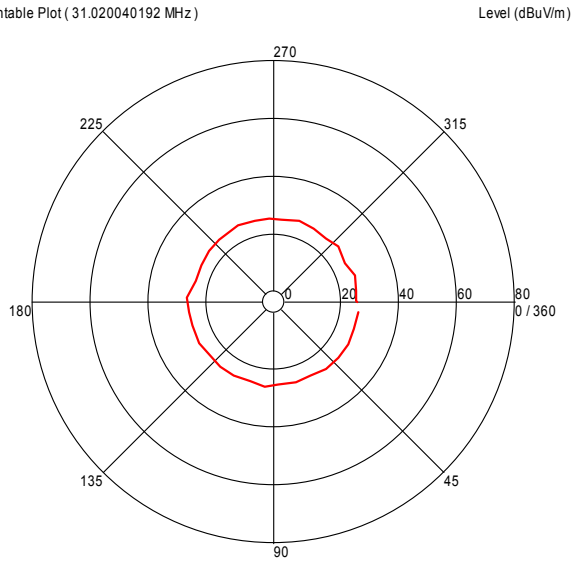
Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
202.362725315 M	16.70	11.849	-23.882	--	--		58	3.08	120 k	
116.515030048 M	23.49	13.700	-25.404	--	--		22	4.00	120 k	
831.83366692 M	26.87	21.637	-23.281	--	--		68	4.00	120 k	
31.020040192 M	23.18	20.586	-26.241	--	--	--	173	3.56	120 k	
50.299399154 M	23.27	7.810	-25.877	--	--		1	1.05	120 k	
54.492384519 M	26.91	7.049	-25.971	--	--		0	2.31	120 k	

Trace2: Measured Quasi Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
202.362725315 M	9.79	11.849	-23.882	33.040	-23.25		58	3.08	120 k	
116.515030048 M	13.48	13.700	-25.404	33.040	-19.56		22	4.00	120 k	
831.83366692 M	20.06	21.637	-23.281	35.540	-15.48		68	4.00	120 k	
31.020040192 M	16.28	20.586	-26.241	29.540	-13.26	--	173	3.56	120 k	
54.492384519 M	16.39	7.049	-25.971	29.540	-13.15		0	2.31	120 k	
50.299399154 M	19.74	7.810	-25.877	29.540	-9.80		1	1.05	120 k	

Azimuth Plots

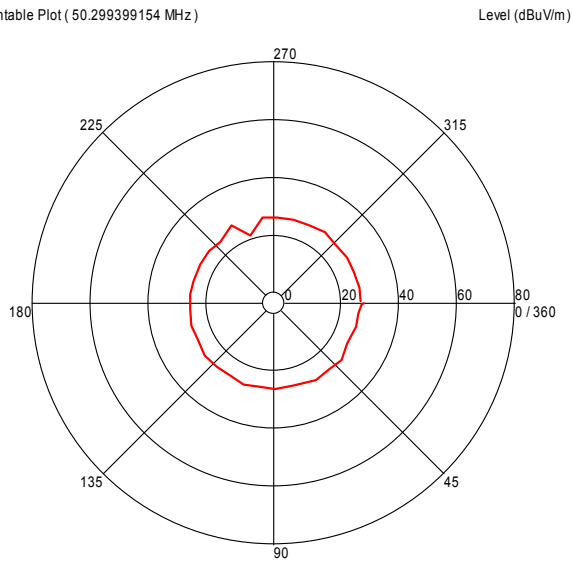
Turntable Plot (31.020040192 MHz)



All Polarities

Azimuth (Degrees)

Turntable Plot (50.299399154 MHz)

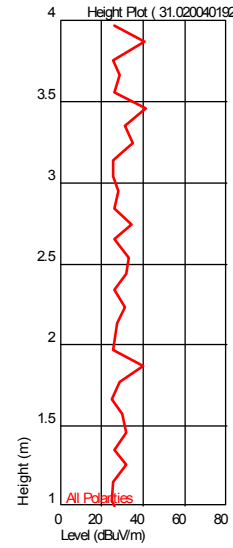


All Polarities

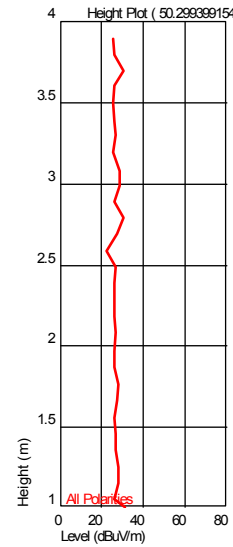
Azimuth (Degrees)

Turntable Plots

Height Plot (31.020040192 MHz)

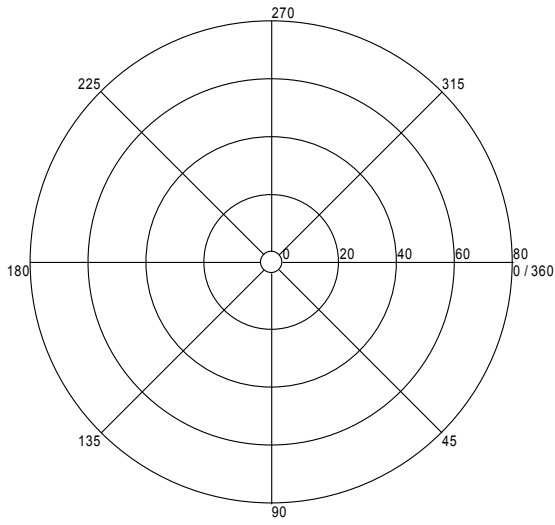


Height Plot (50.299399154 MHz)



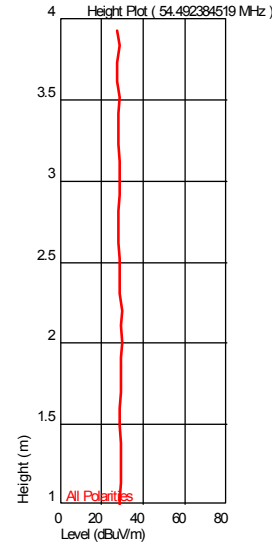
Turntable Plot (54.492384519 MHz)

Level (dBuV/m)



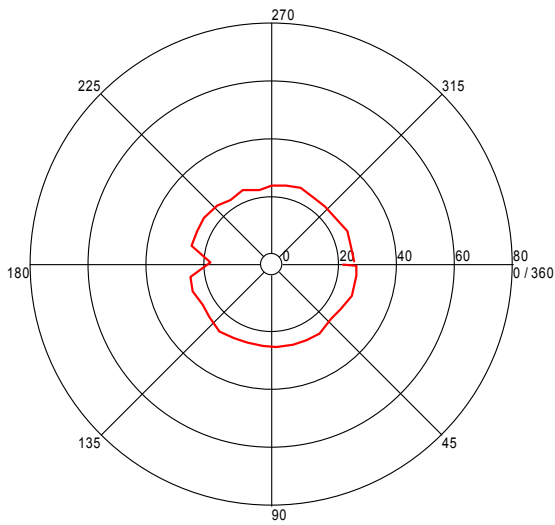
All Polarities

Azimuth (Degrees)



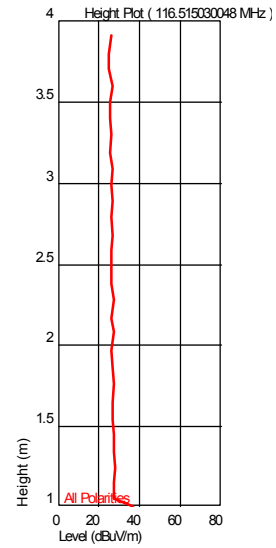
Turntable Plot (116.515030048 MHz)

Level (dBuV/m)



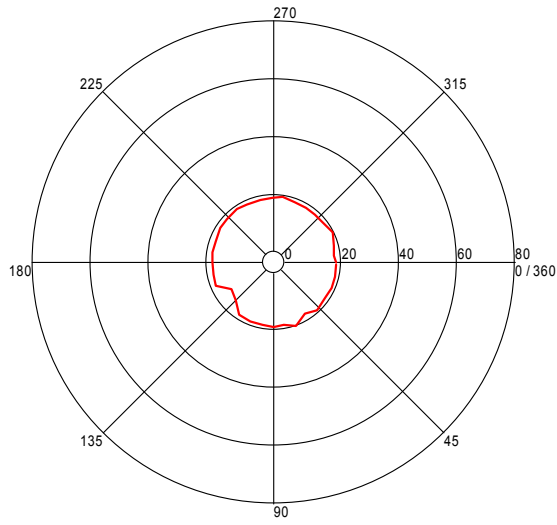
All Polarities

Azimuth (Degrees)



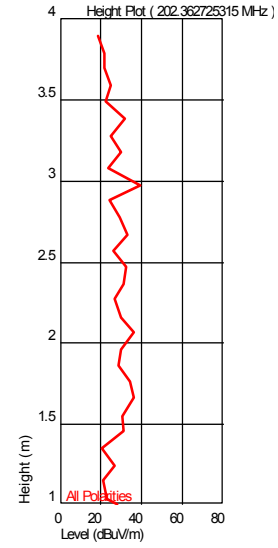
Turntable Plot (202.362725315 MHz)

Level (dBuV/m)



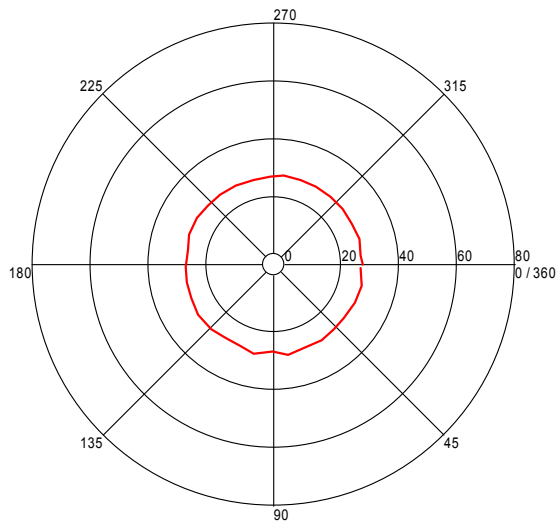
All Polarities

Azimuth (Degrees)



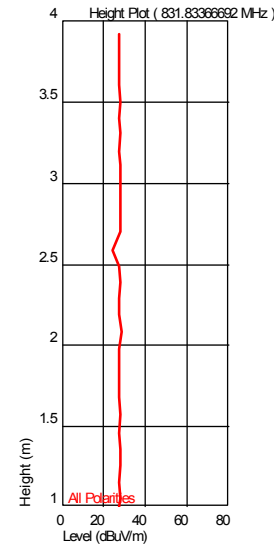
Turntable Plot (831.83366692 MHz)

Level (dBuV/m)



All Polarities

Azimuth (Degrees)



2465 MHz Spurious Radiated Emissions (1-25 GHz), X-Axis

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/17/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 19C 32% 1016mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): Y Voltage/Frequency: Laptop USB Powered Frequency Range: 1-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
First Channel Set: Low 2465MHz, Mid 2469MHz & 2467MHz, High 2471MHz													
2465MHz Spurious Emissions. X-Axis (EUT sits on cable side), 1-3 GHz was performed with no pre-amp. No emissions were detected													
REA004 and pre-amp 145014. Ref power at 100kHz = 107.93, 20dBc = 87.93 dBuV/m. AVG = Peak Reading - 13.9 dB (Average factor)													
PK	H	4930.000	50.82	34.27	8.81	32.47	0.00	61.44	74.00	-12.56	1/3MHz	RB	RB
AVG	H	4930.000	36.92	34.27	8.81	32.47	0.00	47.54	54.00	-6.46	1/3MHz	RB	RB
PK	V	7395.000	48.82	35.79	11.15	32.21	0.00	63.55	74.00	-10.45	1/3MHz	RB	RB
AVG	V	7395.000	34.92	35.79	11.15	32.21	0.00	49.65	54.00	-4.35	1/3MHz	RB	RB
PK, NF	V	9860.000	30.67	37.05	13.35	30.58	0.00	50.50	87.93	-37.43	100/300kHz		
AVG, NF	V	9860.000	16.77	37.05	13.35	30.58	0.00	36.60	67.93	-31.33	100/300kHz		
PK, NF	V	12325.000	41.00	39.13	14.71	32.25	0.00	62.59	74.00	-11.41	1/3MHz	RB	RB
AVG, NF	V	12325.000	27.10	39.13	14.71	32.25	0.00	48.69	54.00	-5.31	1/3MHz	RB	RB
PK, NF	V	14790.000	29.80	39.72	15.51	29.97	0.00	55.06	87.93	-32.87	100/300kHz		
AVG, NF	V	14790.000	15.90	39.72	15.51	29.97	0.00	41.16	67.93	-26.77	100/300kHz		
PK, NF	V	17255.000	31.25	42.10	19.20	32.18	0.00	60.36	87.93	-27.57	100/300kHz		
AVG, NF	V	17255.000	17.35	42.10	19.20	32.18	0.00	46.46	67.93	-21.47	100/300kHz		

Hand scan testing - 15-18 GHz, test equipment used: ETS002, 145014, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

Handscan testing - 18-25 GHz, test equipment used: EMC04, REA006, PRE9, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

2465 MHz Spurious Radiated Emissions (1-25 GHz), Y-Axis

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/17/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 19C 32% 1016mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): Y Voltage/Frequency: Laptop USB Powered Frequency Range: 1-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
First Channel Set: Low 2465MHz, Mid 2469MHz & 2467MHz, High 2471MHz													
2465MHz Spurious Emissions. Y-Axis (EUT sits on its long side), 1-3 GHz was performed with no pre-amp. No emissions were detected													
REA004 and pre-amp 145014, Ref power at 100kHz = 107.93, 20dBc = 87.93 dBuV/m. AVG = Peak Reading - 13.9 dB (Average factor)													
PK	V	4930.000	53.54	34.27	8.81	32.47	0.00	64.16	74.00	-9.84	1/3MHz	RB	RB
AVG	V	4930.000	39.64	34.27	8.81	32.47	0.00	50.26	54.00	-3.74	1/3MHz	RB	RB
PK	H	7395.000	47.17	35.79	11.15	32.21	0.00	61.90	74.00	-12.10	1/3MHz	RB	RB
AVG	H	7395.000	33.27	35.79	11.15	32.21	0.00	48.00	54.00	-6.00	1/3MHz	RB	RB
PK, NF	V	9860.000	30.67	37.05	13.35	30.58	0.00	50.50	87.93	-37.43	100/300kHz		
AVG, NF	V	9860.000	16.77	37.05	13.35	30.58	0.00	36.60	67.93	-31.33	100/300kHz		
PK, NF	V	12325.000	41.00	39.13	14.71	32.25	0.00	62.59	74.00	-11.41	1/3MHz	RB	RB
AVG, NF	V	12325.000	27.10	39.13	14.71	32.25	0.00	48.69	54.00	-5.31	1/3MHz	RB	RB
PK, NF	V	14790.000	29.80	39.72	15.51	29.97	0.00	55.06	87.93	-32.87	100/300kHz		
AVG, NF	V	14790.000	15.90	39.72	15.51	29.97	0.00	41.16	67.93	-26.77	100/300kHz		
PK, NF	V	17255.000	31.25	42.10	19.20	32.18	0.00	60.36	87.93	-27.57	100/300kHz		
AVG, NF	V	17255.000	17.35	42.10	19.20	32.18	0.00	46.46	67.93	-21.47	100/300kHz		

Hand scan testing - 15-18 GHz, test equipment used: ETS002, 145014, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

Handscan testing - 18-25 GHz, test equipment used: EMC04, REA006, PRE9, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

2465 MHz Spurious Radiated Emissions (1-25 GHz), Z-Axis

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/17/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 19C 32% 1016mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): Y Voltage/Frequency: Laptop USB Powered Frequency Range: 1-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
First Channel Set: Low 2465MHz, Mid 2469MHz & 2467MHz, High 2471MHz													
2465MHz Spurious Emissions. Z-Axis(EUT sits flat), 1-3 GHz was performed with no pre-amp. No emissions were detected													
REA004 and pre-amp 145014. Ref power at 100kHz = 107.93, 20dBc = 87.93 dBuV/m. AVG = Peak Reading - 13.9 dB (Average factor)													
PK	H	4930.000	55.05	34.27	8.81	32.47	0.00	65.67	74.00	-8.33	1/3MHz	RB	RB
AVG	H	4930.000	41.15	34.27	8.81	32.47	0.00	51.77	54.00	-2.23	1/3MHz	RB	RB
PK	V	7395.000	47.36	35.79	11.15	32.21	0.00	62.09	74.00	-11.91	1/3MHz	RB	RB
AVG	V	7395.000	33.46	35.79	11.15	32.21	0.00	48.19	54.00	-5.81	1/3MHz	RB	RB
PK, NF	V	9860.000	30.67	37.05	13.35	30.58	0.00	50.50	87.93	-37.43	100/300kHz		
AVG, NF	V	9860.000	16.77	37.05	13.35	30.58	0.00	36.60	67.93	-31.33	100/300kHz		
PK, NF	V	12325.000	41.00	39.13	14.71	32.25	0.00	62.59	74.00	-11.41	1/3MHz	RB	RB
AVG, NF	V	12325.000	27.10	39.13	14.71	32.25	0.00	48.69	54.00	-5.31	1/3MHz	RB	RB
PK, NF	V	14790.000	29.80	39.72	15.51	29.97	0.00	55.06	87.93	-32.87	100/300kHz		
AVG, NF	V	14790.000	15.90	39.72	15.51	29.97	0.00	41.16	67.93	-26.77	100/300kHz		
PK, NF	V	17255.000	31.25	42.10	19.20	32.18	0.00	60.36	87.93	-27.57	100/300kHz		
AVG, NF	V	17255.000	17.35	42.10	19.20	32.18	0.00	46.46	67.93	-21.47	100/300kHz		

Hand scan testing - 15-18 GHz, test equipment used: ETS002, 145014, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

Handscan testing - 18-25 GHz, test equipment used: EMC04, REA006, PRE9, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

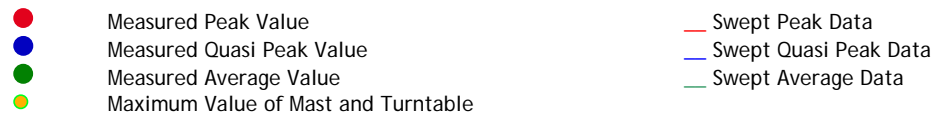
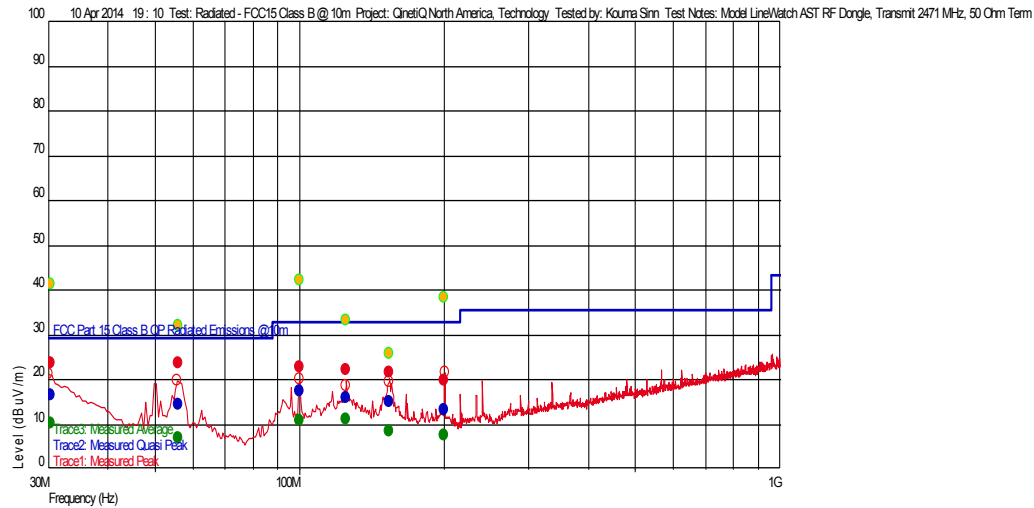
Transmits 2471 MHz, 50 Ohm Terminator (30-1000 MHz)

Test Information

Test Details User Entry
Test: Radiated - FCC15 Class B @ 10m
Project: QinetiQ North America, Technology
Test Notes: Model PRD-1102196002, Transmits 2471 MHz, 50 Ohm Term
Temperature: 22C
Humidity: 23%, 1007mbar
Tested by: Kouma Sinn
Test Started: 10 Apr 2014 19 : 10

Additional Information

Prescan Emission Graph



Emissions Test Data

Trace1: Measured Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (-), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
200.035871439 M	19.96	12.687	-23.890	--	--		267	2.18	120 k	
154.179960172 M	21.73	12.600	-25.136	--	--		338	1.37	120 k	
125.034669281 M	22.23	14.307	-25.365	--	--		297	1.05	120 k	
99.951903888 M	22.80	10.381	-25.480	--	--		359	4.00	120 k	
56.039478932 M	23.61	7.104	-26.006	--	--		8	1.46	120 k	
30.405611222 M	23.66	21.016	-26.246	--	--		1	1.86	120 k	

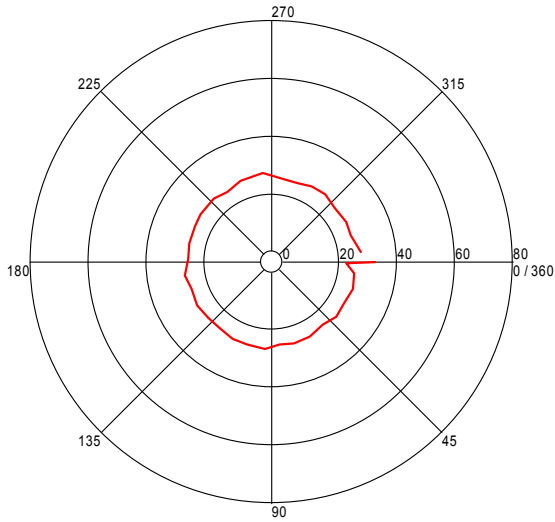
Trace2: Measured Quasi Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (-), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
200.035871439 M	13.14	12.687	-23.890	33.040	-19.90		267	2.18	120 k	
154.179960172 M	15.01	12.600	-25.136	33.040	-18.03		338	1.37	120 k	
125.034669281 M	15.98	14.307	-25.365	33.040	-17.06		297	1.05	120 k	
99.951903888 M	17.36	10.381	-25.480	33.040	-15.68		359	4.00	120 k	
56.039478932 M	14.51	7.104	-26.006	29.540	-15.03		8	1.46	120 k	
30.405611222 M	16.71	21.016	-26.246	29.540	-12.83		1	1.86	120 k	

Azimuth Plots

Turntable Plot (30.405611222 MHz)

Level (dBuV/m)

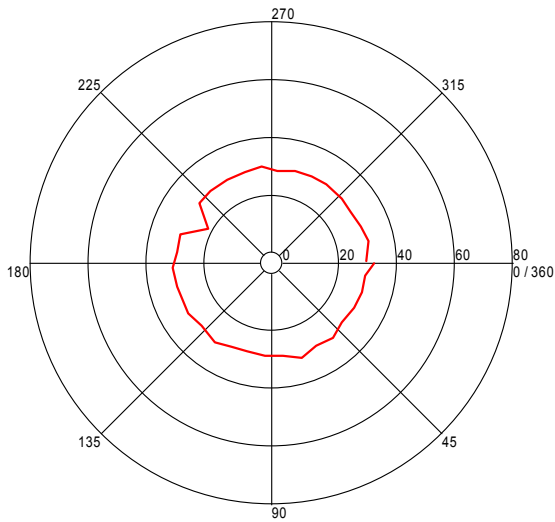


All Polarities

Azimuth (Degrees)

Turntable Plot (56.039478932 MHz)

Level (dBuV/m)

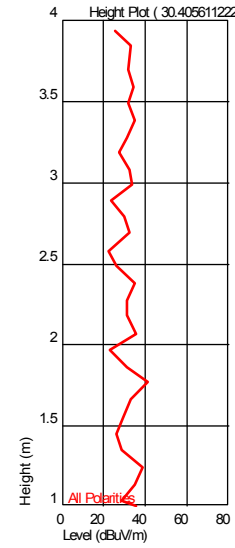


All Polarities

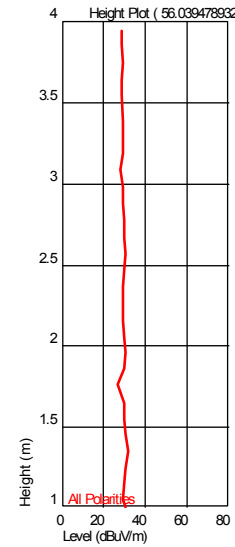
Azimuth (Degrees)

Turntable Plots

Height Plot (30.405611222 MHz)

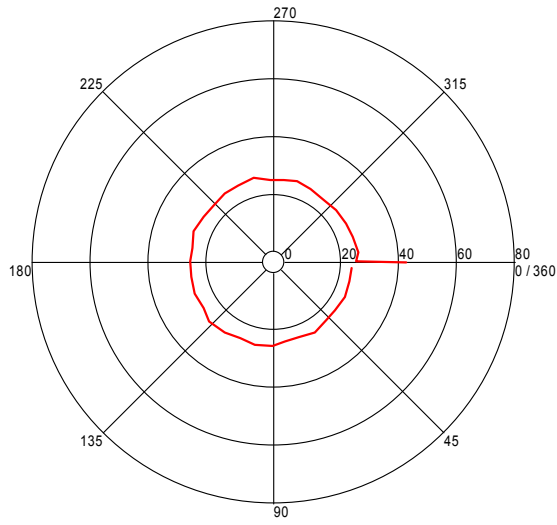


Height Plot (56.039478932 MHz)



Turntable Plot (99.951903888 MHz)

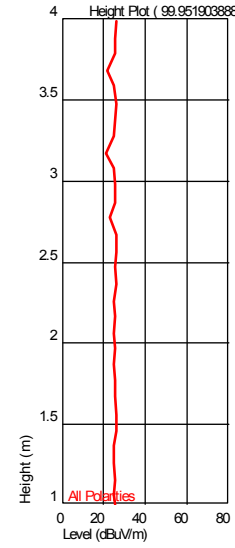
Level (dBuV/m)



All Polarities

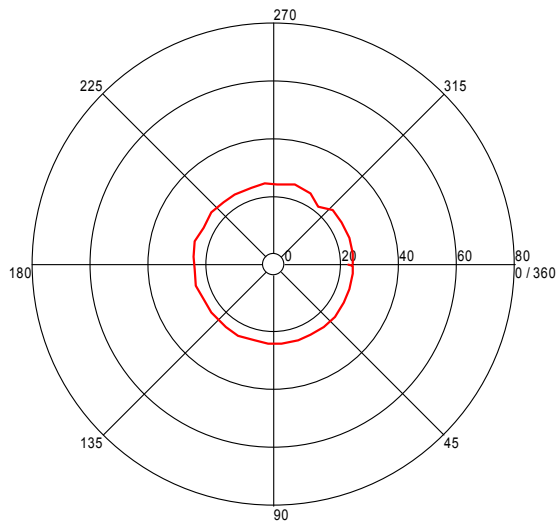
Azimuth (Degrees)

Height Plot (99.951903888 MHz)



Turntable Plot (125.034669281 MHz)

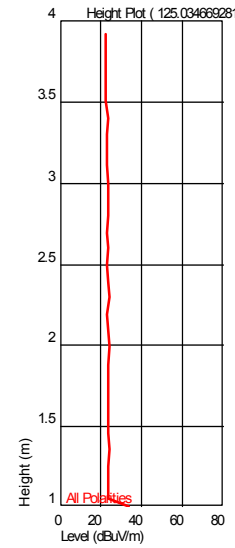
Level (dBuV/m)



All Polarities

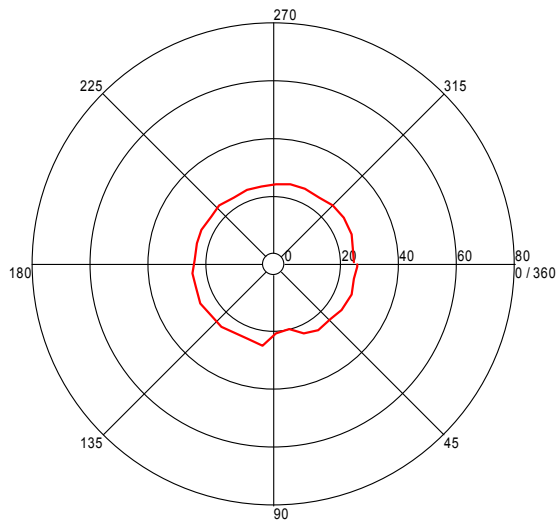
Azimuth (Degrees)

Height Plot (125.034669281 MHz)



Turntable Plot (154.179960172 MHz)

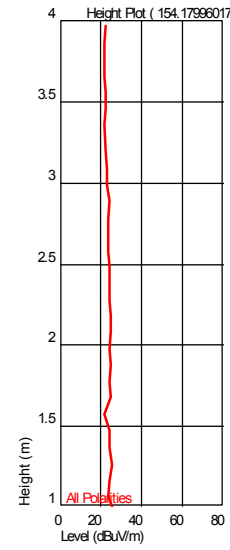
Level (dBuV/m)



All Polarities

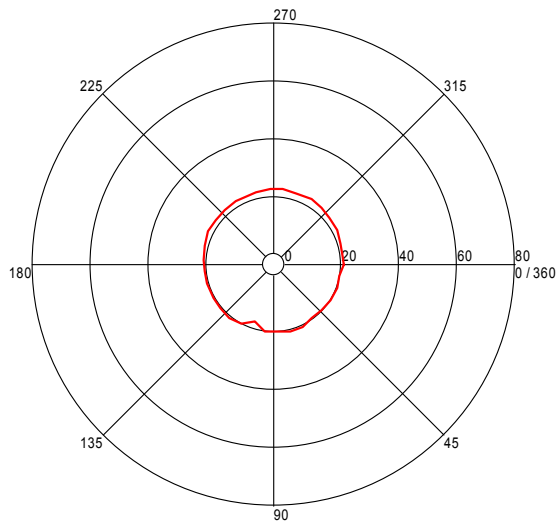
Azimuth (Degrees)

Height Plot (154.179960172 MHz)



Turntable Plot (200.035871439 MHz)

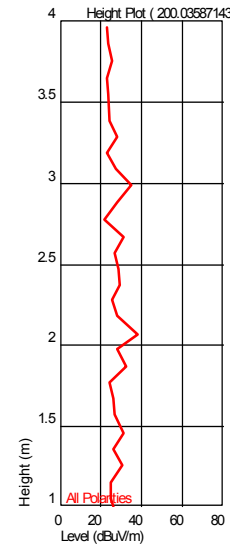
Level (dBuV/m)



All Polarities

Azimuth (Degrees)

Height Plot (200.035871439 MHz)



2471 MHz Spurious Radiated Emissions (1-25 GHz), X-Axis

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/17/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 19C 32% 1016mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): Y Voltage/Frequency: Laptop USB Powered Frequency Range: 1-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
2471MHz Spurious Emissions. X-Axis (EUT sits on cable side). 1-3 GHz was performed with no pre-amp. No emissions were detected													
REA004 and pre-amp 145014, Ref power at 100kHz = 107.93, 20dBc = 87.93 dBuV/m. AVG = Peak Reading - 13.9 dB (Average factor)													
PK	H	4942.000	51.50	34.27	8.83	32.44	0.00	62.16	74.00	-11.84	1/3MHz	RB	RB
AVG	H	4942.000	37.60	34.27	8.83	32.44	0.00	48.26	54.00	-5.74	1/3MHz	RB	RB
PK	H	7413.000	48.20	35.79	11.17	32.20	0.00	62.95	74.00	-11.05	1/3MHz	RB	RB
AVG	H	7413.000	34.30	35.79	11.17	32.20	0.00	49.05	54.00	-4.95	1/3MHz	RB	RB
PK, NF	V	9884.000	30.68	37.08	13.41	30.25	0.00	50.91	87.87	-36.96	100/300kHz		
AVG, NF	V	9884.000	16.78	37.08	13.41	30.25	0.00	37.01	67.87	-30.86	100/300kHz		
PK, NF	V	12325.000	40.00	39.17	14.69	32.24	0.00	61.61	74.00	-12.39	1/3MHz	RB	RB
AVG, NF	V	12355.000	26.10	39.17	14.69	32.24	0.00	47.71	54.00	-6.29	1/3MHz	RB	RB
PK, NF	V	14826.000	30.46	39.76	15.57	30.08	0.00	55.71	87.87	-32.16	100/300kHz		
AVG, NF	V	14826.000	16.56	39.76	15.57	30.08	0.00	41.81	67.87	-26.06	100/300kHz		
PK, NF	V	17297.000	30.50	42.06	19.73	32.22	0.00	60.07	87.87	-27.80	100/300kHz		
AVG, NF	V	17297.000	16.60	42.06	19.73	32.22	0.00	46.17	67.87	-21.70	100/300kHz		

Hand scan testing - 15-18 GHz, test equipment used: ETS002, 145014, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

Handscan testing - 18-25 GHz, test equipment used: EMC04, REA006, PRE9, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

2471 MHz Spurious Radiated Emissions (1-25 GHz), Y-Axis

Company: QinetiQ North America, Technology

Model #: PRD-1102196002

Serial #: Prototype

Engineers: Kouma Sinn

Project #: G101602013

Standard: FCC Part 15 Subpart C 15.247

Receiver: 145-128

PreAmp: PRE145014 12-18-2014.txt

PreAmp Used? (Y or N): Y

Date(s): 04/17/14

Location: 10m

Antenna & Cables: LF

Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt

Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.

Barometer: MAN1

Filter: NONE

Temp/Humidity/Pressure: 19C

32% 1016mbar

Limit Distance (m): 3

Test Distance (m): 3

Voltage/Frequency: Laptop USB Powered

Frequency Range: 1-25 GHz

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
2471MHz Spurious Emissions. Y-Axis (EUT sits on its long side), 1-3 GHz was performed with no pre-amp. No emissions were detected													
REA004 and pre-amp 145014. Ref power at 100kHz = 107.93, 20dBc = 87.93 dBuV/m. AVG = Peak Reading - 13.9 dB (Average factor)													
PK	H	4942.000	52.24	34.27	8.83	32.44	0.00	62.90	74.00	-11.10	1/3MHz	RB	RB
AVG	H	4942.000	38.34	34.27	8.83	32.44	0.00	49.00	54.00	-5.00	1/3MHz	RB	RB
PK	H	7413.000	46.10	35.79	11.17	32.20	0.00	60.85	74.00	-13.15	1/3MHz	RB	RB
AVG	H	7413.000	32.20	35.79	11.17	32.20	0.00	46.95	54.00	-7.05	1/3MHz	RB	RB
PK, NF	V	9884.000	30.68	37.08	13.41	30.25	0.00	50.91	87.87	-36.96	100/300kHz		
AVG, NF	V	9884.000	16.78	37.08	13.41	30.25	0.00	37.01	67.93	-30.92	100/300kHz		
PK, NF	V	12355.000	40.00	39.17	14.69	32.24	0.00	61.61	74.00	-12.39	1/3MHz	RB	RB
AVG, NF	V	12355.000	26.10	39.17	14.69	32.24	0.00	47.71	54.00	-6.29	1/3MHz	RB	RB
PK	V	14826.000	30.46	39.76	15.57	30.08	0.00	55.71	87.87	-32.16	100/300kHz		
AVG	V	14826.000	16.56	39.76	15.57	30.08	0.00	41.81	67.93	-26.12	100/300kHz		
PK	V	17297.000	30.50	42.06	19.73	32.22	0.00	60.07	87.87	-27.80	100/300kHz		
AVG	V	17297.000	16.60	42.06	19.73	32.22	0.00	46.17	67.93	-21.76	100/300kHz		

Hand scan testing - 15-18 GHz, test equipment used: ETS002, 145014, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.

No emissions were detected

Handscan testing - 18-25 GHz, test equipment used: EMC04, REA006, PRE9, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.

No emissions were detected

2471 MHz Spurious Radiated Emissions (1-25 GHz), Z-Axis

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/17/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 19C 32% 1016mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): Y Voltage/Frequency: Laptop USB Powered Frequency Range: 1-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
2471MHz Spurious Emissions. Z-Axis(EUT sits flat), 1-3 GHz was performed with no pre-amp. No emissions were detected													
REA004 and pre-amp 145014. Ref power at 100kHz = 107.87, 20dBc = 87.87 dBuV/m. AVG = Peak Reading - 13.9 dB (Average factor)													
PK	H	4942.000	53.70	34.27	8.83	32.44	0.00	64.36	74.00	-9.64	1/3MHz	RB	RB
AVG	H	4942.000	39.80	34.27	8.83	32.44	0.00	50.46	54.00	-3.54	1/3MHz	RB	RB
PK	V	7413.000	47.46	35.79	11.17	32.20	0.00	62.21	74.00	-11.79	1/3MHz	RB	RB
AVG	V	7413.000	33.56	35.79	11.17	32.20	0.00	48.31	54.00	-5.69	1/3MHz	RB	RB
PK	V	9884.000	30.68	37.08	13.41	30.25	0.00	50.91	87.87	-36.96	100/300kHz		
AVG	V	9884.000	16.78	37.08	13.41	30.25	0.00	20.23	67.87	-47.64	100/300kHz		
PK	V	12355.000	40.00	39.17	14.69	32.24	0.00	61.61	74.00	-12.39	1/3MHz	RB	RB
AVG	V	12355.000	26.10	39.17	14.69	32.24	0.00	47.71	54.00	-6.29	1/3MHz	RB	RB
PK	V	14826.000	30.46	39.76	15.57	30.08	0.00	55.71	87.87	-32.16	100/300kHz		
AVG	V	14826.000	16.56	39.76	15.57	30.08	0.00	41.81	67.87	-26.06	100/300kHz		
PK	V	17297.000	30.50	42.06	19.73	32.22	0.00	60.07	87.87	-27.80	100/300kHz		
AVG	V	17297.000	16.60	42.06	19.73	32.22	0.00	46.17	67.87	-21.70	100/300kHz		

Hand scan testing - 15-18 GHz, test equipment used: ETS002, 145014, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

Handscan testing - 18-25 GHz, test equipment used: EMC04, REA006, PRE9, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

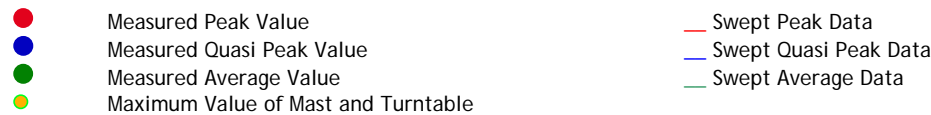
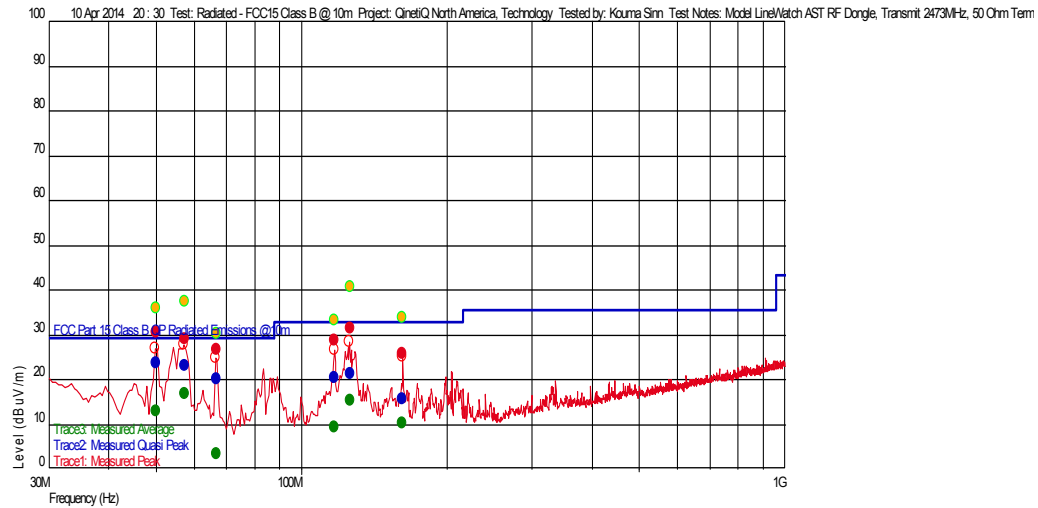
Transmits 2473 MHz, 50 Ohm Terminator (30-1000 MHz)

Test Information

Test Details User Entry
Test: Radiated - FCC15 Class B @ 10m
Project: QinetiQ North America, Technology
Test Notes: Model PRD-1102196002, Transmit 2473MHz, 50 Ohm Term
Temperature: 22C
Humidity: 23%, 1007mbar
Tested by: Kouma Sinn
Test Started: 10 Apr 2014 20 : 30

Additional Information

Prescan Emission Graph



Emissions Test Data

Trace1: Measured Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (-), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
162.051302868 M	25.87	12.295	-24.922	--	--		342	1.15	120 k	
116.967334713 M	28.76	13.700	-25.402	--	--		58	1.67	120 k	
66.78537095 M	26.61	7.979	-25.915	--	--		74	1.45	120 k	
126.040280615 M	31.58	14.500	-25.360	--	--		312	1.24	120 k	
57.281763669 M	29.00	7.228	-26.034	--	--		30	2.07	120 k	
50.168537375 M	30.55	7.849	-25.874	--	--		146	1.65	120 k	

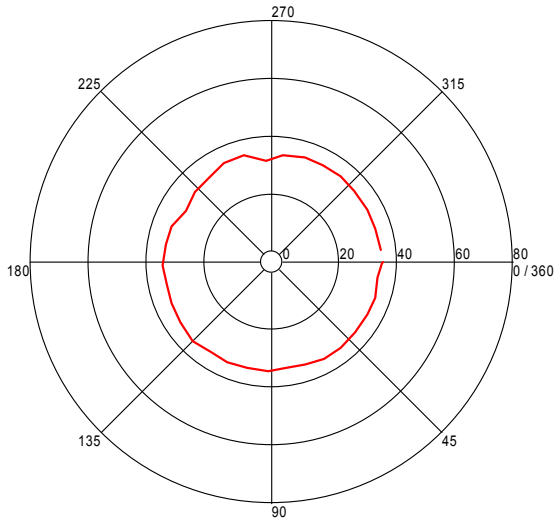
Trace2: Measured Quasi Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (-), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
162.051302868 M	15.73	12.295	-24.922	33.040	-17.31		342	1.15	120 k	
116.967334713 M	20.37	13.700	-25.402	33.040	-12.67		58	1.67	120 k	
126.040280615 M	21.46	14.500	-25.360	33.040	-11.58		312	1.24	120 k	
66.78537095 M	20.28	7.979	-25.915	29.540	-9.26		74	1.45	120 k	
57.281763669 M	23.23	7.228	-26.034	29.540	-6.31		30	2.07	120 k	
50.168537375 M	23.69	7.849	-25.874	29.540	-5.85		146	1.65	120 k	

Azimuth Plots

Turntable Plot (50.168537375 MHz)

Level (dBuV/m)

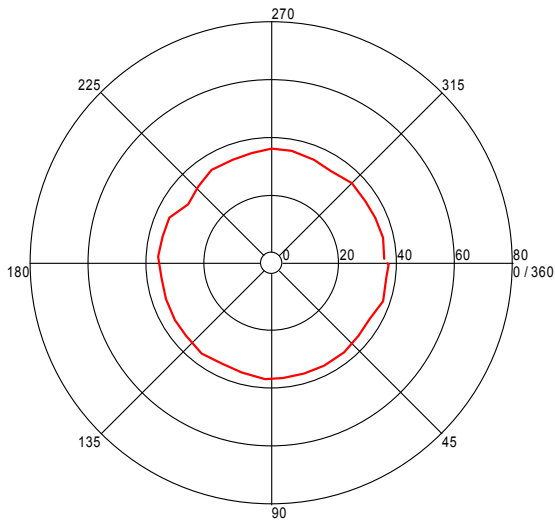


All Polarities

Azimuth (Degrees)

Turntable Plot (57.281763669 MHz)

Level (dBuV/m)

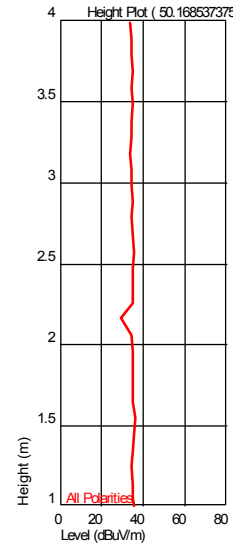


All Polarities

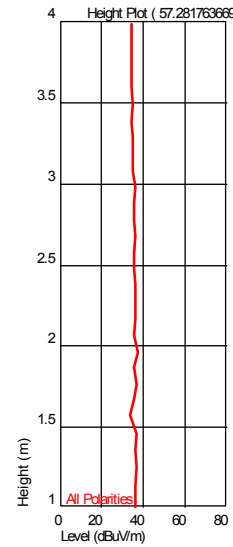
Azimuth (Degrees)

Turntable Plots

Height Plot (50.168537375 MHz)

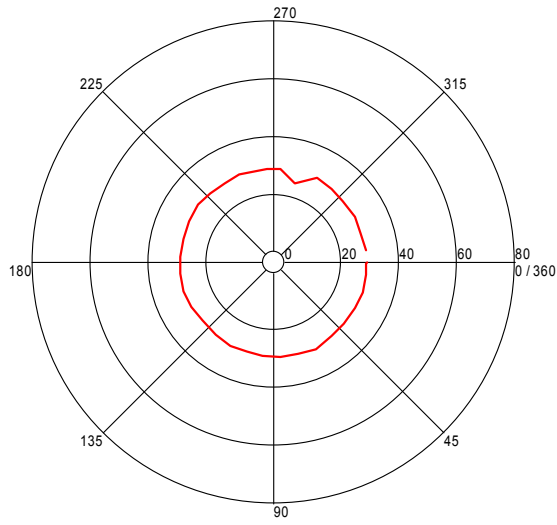


Height Plot (57.281763669 MHz)



Turntable Plot (66.78537095 MHz)

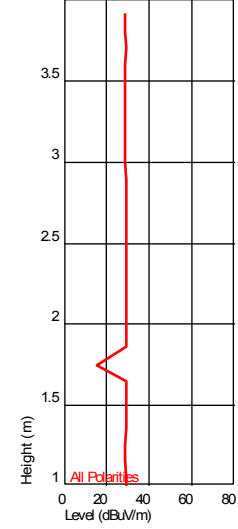
Level (dBuV/m)



All Polarities

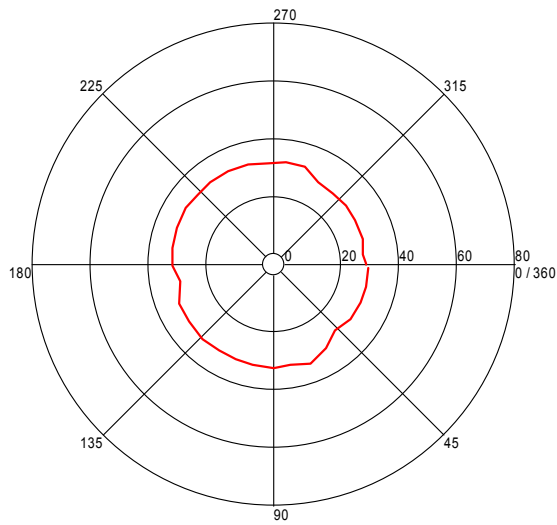
Azimuth (Degrees)

Height Plot (66.78537095 MHz)



Turntable Plot (116.967334713 MHz)

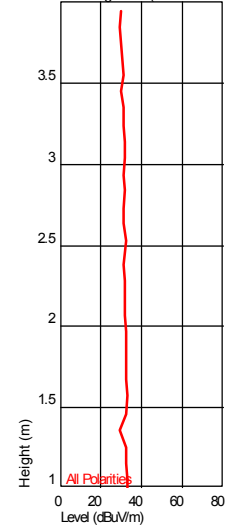
Level (dBuV/m)



All Polarities

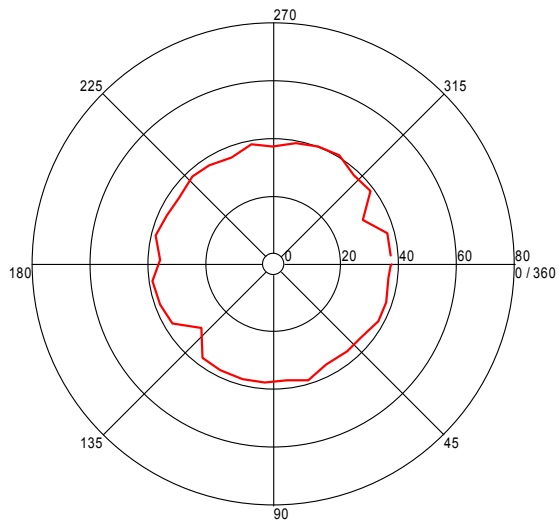
Azimuth (Degrees)

Height Plot (116.967334713 MHz)



Turntable Plot (126.040280615 MHz)

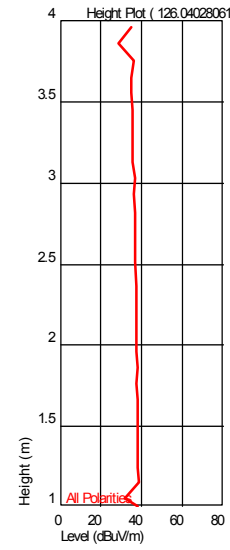
Level (dBuV/m)



All Polarities

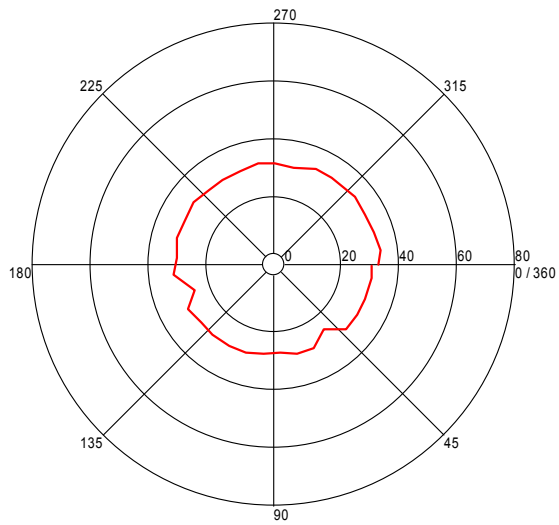
Azimuth (Degrees)

Height Plot (126.040280615 MHz)



Turntable Plot (162.051302868 MHz)

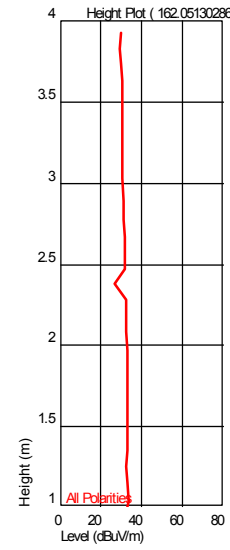
Level (dBuV/m)



All Polarities

Azimuth (Degrees)

Height Plot (162.051302868 MHz)



2473 MHz Spurious Radiated Emissions (1-25 GHz), X-Axis

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/17/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 19C 32% 1016mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): Y Voltage/Frequency: Laptop USB Powered Frequency Range: 1-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
First Channel Set: Low 2473MHz, Mid 2475MHz & 2477MHz, High 2479MHz													
04/17/14, High 2473MHz Spurious Emissions, Y-Axis (EUT sits on its long side), 1-3 GHz was performed with no pre-amp. No emissions were detected													
REA004 and pre-amp 145014. Ref power at 100kHz = 108.65, 20dBc = 88.65 dBuV/m. AVG = Peak Reading - 13.9 dB (Average factor)													
PK	V	4946.000	51.43	34.27	8.84	32.43	0.00	62.11	74.00	-11.89	1/3MHz	RB	RB
AVG	V	4946.000	37.53	34.27	8.84	32.43	0.00	48.21	54.00	-5.79	1/3MHz	RB	RB
PK	V	7419.000	44.56	35.78	11.17	32.20	0.00	59.32	74.00	-14.68	1/3MHz	RB	RB
AVG	V	7419.000	30.66	35.78	11.17	32.20	0.00	45.42	54.00	-8.58	1/3MHz	RB	RB
PK, NF	H	9892.000	30.30	37.08	13.43	30.14	0.00	50.67	88.65	-37.98	100/300kHz		
AVG, NF	H	9892.000	16.40	37.08	13.43	30.14	0.00	36.77	68.85	-32.08	100/300kHz		
PK, NF	H	12365.000	41.20	39.18	14.68	32.24	0.00	62.82	74.00	-11.18	1/3MHz	RB	RB
AVG, NF	H	12365.000	27.30	39.18	14.68	32.24	0.00	48.92	54.00	-5.08	1/3MHz	RB	RB
PK, NF	H	14838.000	31.35	39.77	15.59	30.11	0.00	56.60	88.65	-32.05	100/300kHz		
AVG, NF	H	14838.000	17.45	39.77	15.59	30.11	0.00	42.70	68.85	-26.15	100/300kHz		
PK, NF	H	17311.000	29.95	42.06	19.91	32.23	0.00	59.69	88.65	-28.96	100/300kHz		
AVG, NF	H	17311.000	16.05	42.06	19.91	32.23	0.00	45.79	68.85	-23.06	100/300kHz		

Hand scan testing - 15-18 GHz, test equipment used: ETS002, 145014, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

Handscan testing - 18-25 GHz, test equipment used: EMC04, REA006, PRE9, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

2473 MHz Spurious Radiated Emissions (1-25 GHz), Y-Axis

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/17/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 19C 32% 1016mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): Y Voltage/Frequency: Laptop USB Powered Frequency Range: 1-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
First Channel Set: Low 2473MHz, Mid 2475MHz & 2477MHz, High 2479MHz													
04/17/14, High 2473MHz Spurious Emissions, Y-Axis (EUT sits on its long side), 1-3 GHz was performed with no pre-amp. No emissions were detected													
REA004 and pre-amp 145014. Ref power at 100kHz = 108.65, 20dBc = 88.65 dBuV/m. AVG = Peak Reading - 13.9 dB (Average factor)													
PK	V	4946.000	51.43	34.27	8.84	32.43	0.00	62.11	74.00	-11.89	1/3MHz	RB	RB
AVG	V	4946.000	37.53	34.27	8.84	32.43	0.00	48.21	54.00	-5.79	1/3MHz	RB	RB
PK	V	7419.000	44.56	35.78	11.17	32.20	0.00	59.32	74.00	-14.68	1/3MHz	RB	RB
AVG	V	7419.000	30.66	35.78	11.17	32.20	0.00	45.42	54.00	-8.58	1/3MHz	RB	RB
PK, NF	H	9892.000	30.30	37.08	13.43	30.14	0.00	50.67	88.65	-37.98	100/300kHz		
AVG, NF	H	9892.000	16.40	37.08	13.43	30.14	0.00	36.77	68.65	-31.88	100/300kHz		
PK, NF	H	12365.000	41.20	39.18	14.68	32.24	0.00	62.82	74.00	-11.18	1/3MHz	RB	RB
AVG, NF	H	12365.000	27.30	39.18	14.68	32.24	0.00	48.92	54.00	-5.08	1/3MHz	RB	RB
PK, NF	H	14838.000	31.35	39.77	15.59	30.11	0.00	56.60	88.65	-32.05	100/300kHz		
AVG, NF	H	14838.000	17.45	39.77	15.59	30.11	0.00	42.70	68.65	-25.95	100/300kHz		
PK, NF	H	17311.000	29.95	42.06	19.91	32.23	0.00	59.69	88.65	-28.96	100/300kHz		
AVG, NF	H	17311.000	16.05	42.06	19.91	32.23	0.00	45.79	68.65	-22.86	100/300kHz		

Hand scan testing - 15-18 GHz, test equipment used: ETS002, 145014, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

Handscan testing - 18-25 GHz, test equipment used: EMC04, REA006, PRE9, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

2473 MHz Spurious Radiated Emissions (1-25 GHz), Z-Axis

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/17/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 19C 32% 1016mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): Y Voltage/Frequency: Laptop USB Powered Frequency Range: 1-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
First Channel Set: Low 2473MHz, Mid 2475MHz & 2477MHz, High 2479MHz													
2473MHz Spurious Emissions. Z-Axis(EUT sits flat), 1-3 GHz was performed with no pre-amp. No emissions were detected													
REA004 and pre-amp 145014. Ref power at 100kHz = 108.65, 20dBc = 88.65 dBuV/m. AVG = Peak Reading - 13.9 dB (Average factor)													
PK	H	4946.000	52.38	34.27	8.84	32.43	0.00	63.06	74.00	-10.94	1/3MHz	RB	RB
AVG	H	4946.000	38.48	34.27	8.84	32.43	0.00	49.16	54.00	-4.84	1/3MHz	RB	RB
PK	H	7419.000	45.78	35.78	11.17	32.20	0.00	60.54	74.00	-13.46	1/3MHz	RB	RB
AVG	H	7419.000	31.88	35.78	11.17	32.20	0.00	46.64	54.00	-7.36	1/3MHz	RB	RB
PK, NF	H	9892.000	30.30	37.08	13.43	30.14	0.00	50.67	88.65	-37.98	100/300kHz		
AVG, NF	H	9892.000	16.40	37.08	13.43	30.14	0.00	36.77	68.65	-31.88	100/300kHz		
PK, NF	H	12365.000	41.20	39.18	14.68	32.24	0.00	62.82	74.00	-11.18	1/3MHz	RB	RB
AVG, NF	H	12365.000	27.30	39.18	14.68	32.24	0.00	48.92	54.00	-5.08	1/3MHz	RB	RB
PK, NF	H	14838.000	31.35	39.77	15.59	30.11	0.00	56.60	88.65	-32.05	100/300kHz		
AVG, NF	H	14838.000	17.45	39.77	15.59	30.11	0.00	42.70	68.65	-25.95	100/300kHz		
PK, NF	H	17311.000	29.95	42.06	19.91	32.23	0.00	59.69	88.65	-28.96	100/300kHz		
AVG, NF	H	17311.000	16.05	42.06	19.91	32.23	0.00	45.79	68.65	-22.86	100/300kHz		

Hand scan testing - 15-18 GHz, test equipment used: ETS002, 145014, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

Handscan testing - 18-25 GHz, test equipment used: EMC04, REA006, PRE9, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

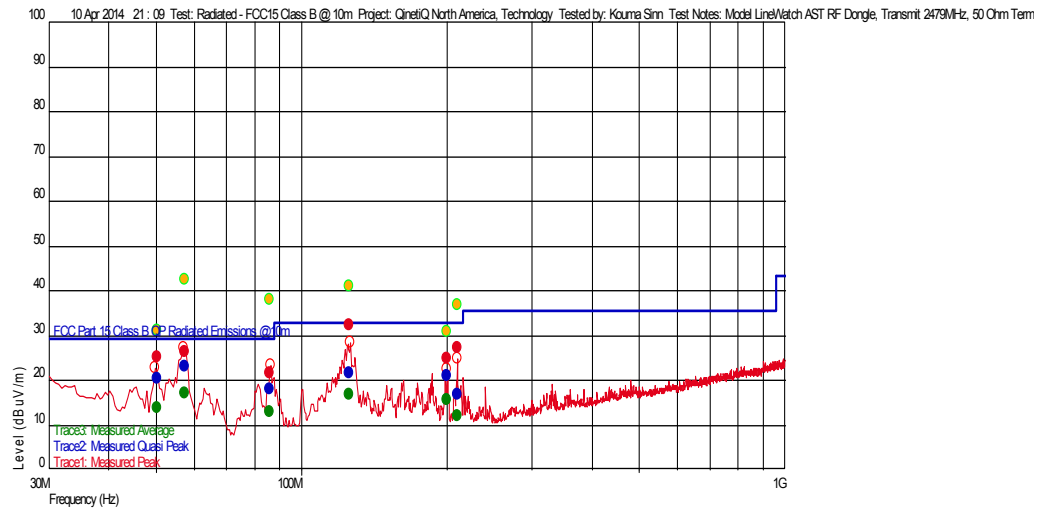
Transmits 2479 MHz, 50 Ohm Terminator (30-1000 MHz)

Test Information

Test Details User Entry
Test: Radiated - FCC15 Class B @ 10m
Project: QinetiQ North America, Technology
Test Notes: Model PRD-1102196002, Transmit 2479MHz, 50 Ohm Term
Temperature: 22C
Humidity: 23%, 1007mbar
Tested by: Kouma Sinn
Test Started: 10 Apr 2014 21 : 09

Additional Information

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace1: Measured Peak

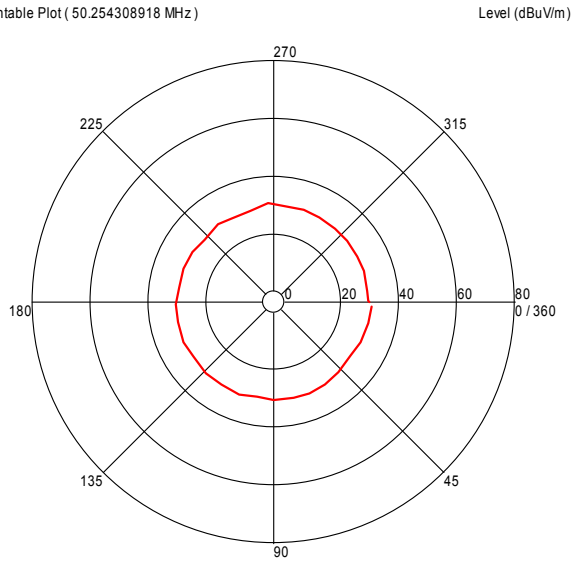
Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
199.622043727 M	25.01	12.700	-23.900	--	--		236	1.67	120 k	
86.042484479 M	21.70	7.400	-25.628	--	--		168	1.05	120 k	
209.973346511 M	27.41	10.701	-23.858	--	--		264	1.04	120 k	
50.254308918 M	25.33	7.824	-25.876	--	--		255	1.15	120 k	
57.371543228 M	26.30	7.237	-26.036	--	--		17	3.38	120 k	
125.969138387 M	32.31	14.494	-25.361	--	--		360	1.78	120 k	

Trace2: Measured Quasi Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (--), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
209.973346511 M	16.81	10.701	-23.858	33.040	-16.23		264	1.04	120 k	
199.622043727 M	21.09	12.700	-23.900	33.040	-11.95		236	1.67	120 k	
86.042484479 M	17.96	7.400	-25.628	29.540	-11.58		168	1.05	120 k	
125.969138387 M	21.63	14.494	-25.361	33.040	-11.41		360	1.78	120 k	
50.254308918 M	20.57	7.824	-25.876	29.540	-8.97		255	1.15	120 k	
57.371543228 M	23.04	7.237	-26.036	29.540	-6.50		17	3.38	120 k	

Azimuth Plots

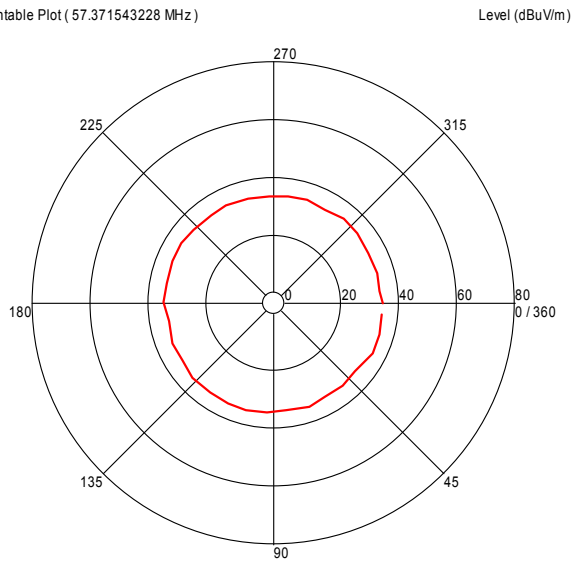
Turntable Plot (50.254308918 MHz)



All Polarities

Azimuth (Degrees)

Turntable Plot (57.371543228 MHz)

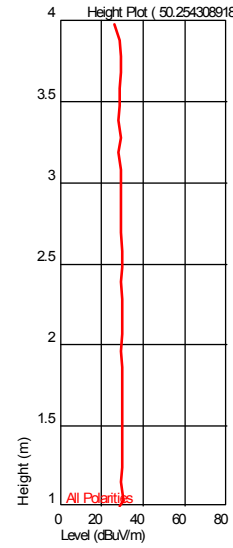


All Polarities

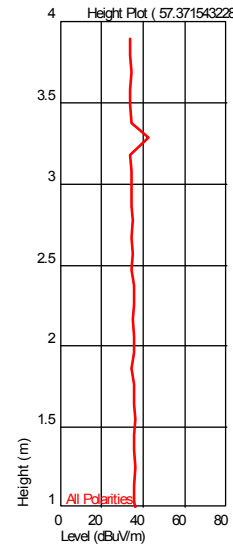
Azimuth (Degrees)

Turntable Plots

Height Plot (50.254308918 MHz)

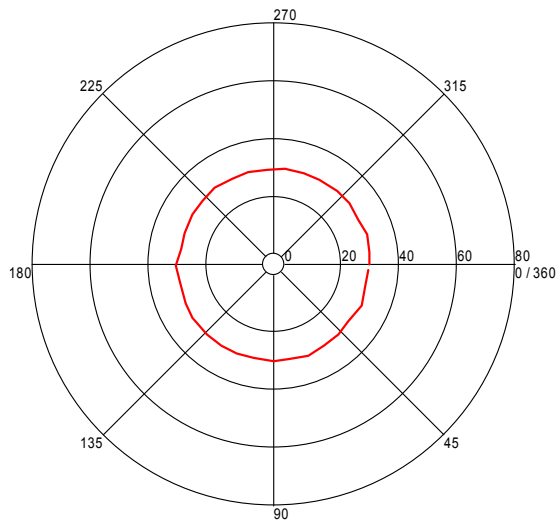


Height Plot (57.371543228 MHz)



Turntable Plot (86.042484479 MHz)

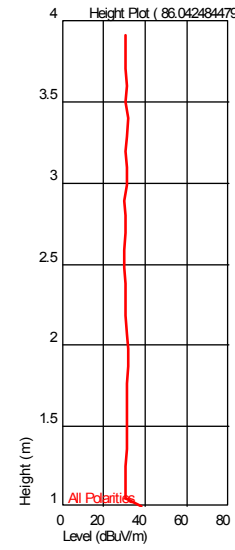
Level (dBuV/m)



All Polarities

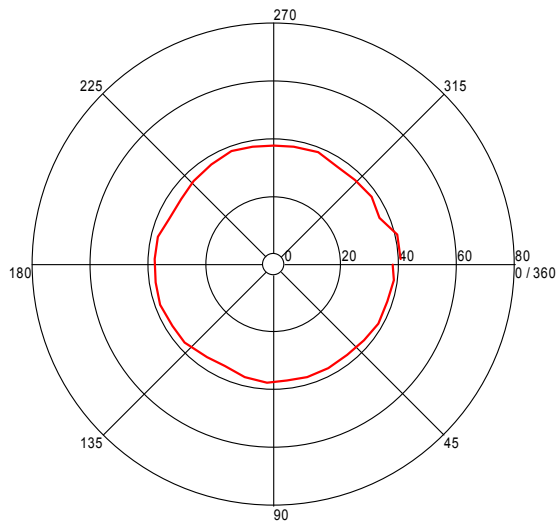
Azimuth (Degrees)

Height Plot (86.042484479 MHz)



Turntable Plot (125.969138387 MHz)

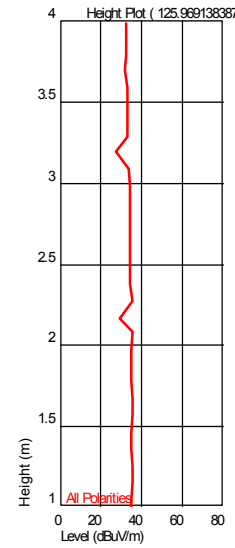
Level (dBuV/m)



All Polarities

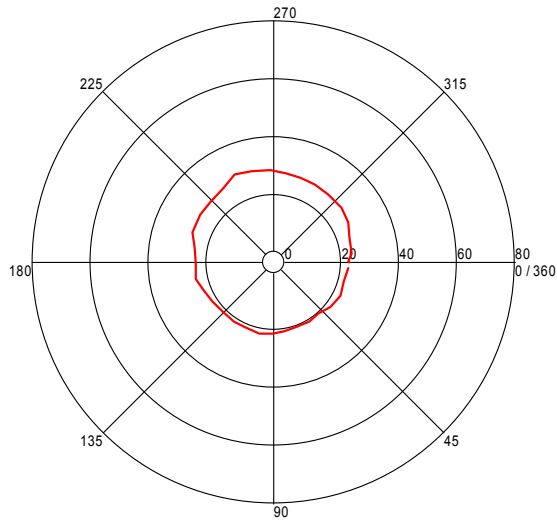
Azimuth (Degrees)

Height Plot (125.969138387 MHz)



Turntable Plot (199.622043727 MHz)

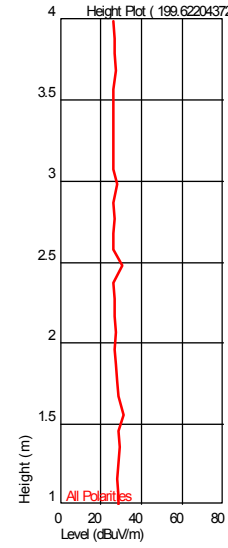
Level (dBuV/m)



All Polarities

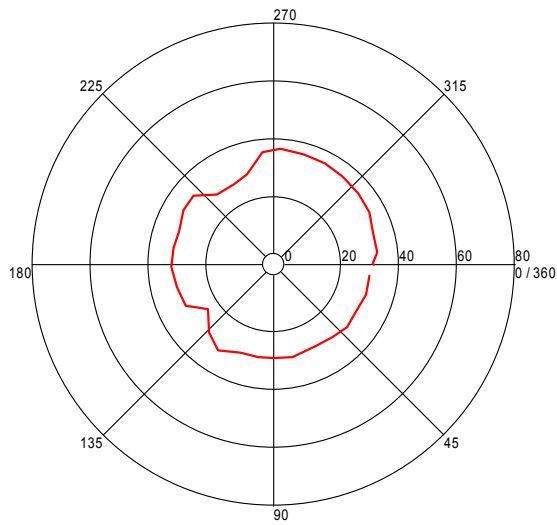
Azimuth (Degrees)

Height Plot (199.622043727 MHz)



Turntable Plot (209.973346511 MHz)

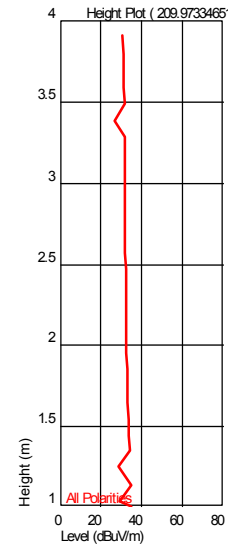
Level (dBuV/m)



All Polarities

Azimuth (Degrees)

Height Plot (209.973346511 MHz)



2479 MHz Spurious Radiated Emissions (1-25 GHz), X-Axis

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/17/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 19C 32% 1016mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): Y Voltage/Frequency: Laptop USB Powered Frequency Range: 1-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
High 2479MHz Spurious Emissions. X-Axis (EUT sits on cable side). 1-3 GHz was performed with no pre-amp. No emissions were detected													
REA004 and pre-amp 145014. Ref power at 100kHz = 107.59, 20dBc = 87.59 dBuV/m. AVG = Peak Reading - 13.9 dB (Average factor)													
PK	H	4958.000	50.00	34.28	8.85	32.40	0.00	60.72	74.00	-13.28	1/3MHz	RB	RB
AVG	H	4958.000	36.10	34.28	8.85	32.40	0.00	46.82	54.00	-7.18	1/3MHz	RB	RB
PK	H	7437.000	47.00	35.78	11.18	32.19	0.00	61.78	74.00	-12.22	1/3MHz	RB	RB
AVG	H	7437.000	33.10	35.78	11.18	32.19	0.00	47.88	54.00	-6.12	1/3MHz	RB	RB
PK, NF	H	9916.000	29.70	37.10	13.48	29.82	0.00	50.47	87.59	-37.12	100/300kHz		
AVG, NF	H	9916.000	15.80	37.10	13.48	29.82	0.00	36.57	67.59	-31.02	100/300kHz		
PK, NF	H	12395.000	39.91	39.21	14.66	32.22	0.00	61.56	74.00	-12.44	1/3MHz	RB	RB
AVG, NF	H	12395.000	26.01	39.21	14.66	32.22	0.00	47.66	54.00	-6.34	1/3MHz	RB	RB
PK, NF	H	14874.000	28.50	39.80	15.66	30.22	0.00	53.74	87.59	-33.85	100/300kHz		
AVG, NF	H	14874.000	14.60	39.80	15.66	30.22	0.00	39.84	67.59	-27.75	100/300kHz		
PK, NF	H	17353.000	31.31	42.07	20.74	32.27	0.00	61.85	87.59	-25.74	100/300kHz		
AVG, NF	H	17353.000	17.41	42.07	20.74	32.27	0.00	47.95	67.59	-19.64	100/300kHz		

Hand scan testing - 15-18 GHz, test equipment used: ETS002, 145014, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

Handscan testing - 18-25 GHz, test equipment used: EMC04, REA006, PRE9, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

2479 MHz Spurious Radiated Emissions (1-25GHz), Y-Axis

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/17/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 19C 32% 1016mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): Y Voltage/Frequency: Laptop USB Powered Frequency Range: 1-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
2479MHz Spurious Emissions. Y-Axis (EUT sits on its long side), 1-3 GHz was performed with no pre-amp. No emissions were detected													
REA004 and pre-amp 145014. Ref power at 100kHz = 107.59, 20dBc = 87.59 dBuV/m. AVG = Peak Reading - 13.9 dB (Average factor)													
PK	V	4958.000	50.91	34.28	8.85	32.40	0.00	61.63	74.00	-12.37	1/3MHz	RB	RB
AVG	V	4958.000	37.01	34.28	8.85	32.40	0.00	47.73	54.00	-6.27	1/3MHz	RB	RB
PK	V	7437.000	47.04	35.78	11.18	32.19	0.00	61.82	74.00	-12.18	1/3MHz	RB	RB
AVG	V	7437.000	33.14	35.78	11.18	32.19	0.00	47.92	54.00	-6.08	1/3MHz	RB	RB
PK, NF	H	9916.000	29.70	37.10	13.48	29.82	0.00	50.47	87.59	-37.12	100/300kHz		
AVG, NF	H	9916.000	15.80	37.10	13.48	29.82	0.00	36.57	67.59	-31.02	100/300kHz		
PK, NF	H	12395.000	39.91	39.21	14.66	32.22	0.00	61.56	74.00	-12.44	1/3MHz	RB	RB
AVG, NF	H	12395.000	26.01	39.21	14.66	32.22	0.00	47.66	54.00	-6.34	1/3MHz	RB	RB
PK, NF	H	14874.000	28.50	39.80	15.66	30.22	0.00	53.74	87.59	-33.85	100/300kHz		
AVG, NF	H	14874.000	14.60	39.80	15.66	30.22	0.00	39.84	67.59	-27.75	100/300kHz		
PK, NF	H	17353.000	31.31	42.07	20.74	32.27	0.00	61.85	87.59	-25.74	100/300kHz		
AVG, NF	H	17353.000	17.41	42.07	20.74	32.27	0.00	47.95	67.59	-19.64	100/300kHz		

Hand scan testing - 15-18 GHz, test equipment used: ETS002, 145014, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

Handscan testing - 18-25 GHz, test equipment used: EMC04, REA006, PRE9, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

2479 MHz Spurious Radiated Emissions (1-25GHz), Z-Axis

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/17/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 19C 32% 1016mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): Y Voltage/Frequency: Laptop USB Powered Frequency Range: 1-25GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
2479MHz Spurious Emissions. Z-Axis(EUT sits flat), 1-3 GHz was performed with no pre-amp. No emissions were detected													
REA004 and pre-amp 145014. Ref power at 100kHz = 107.59, 20dBc = 87.59 dBuV/m. AVG = Peak Reading - 13.9 dB (Average factor)													
PK	H	4958.000	52.04	34.28	8.85	32.40	0.00	62.76	74.00	-11.24	1/3MHz	RB	RB
AVG	H	4958.000	38.14	34.28	8.85	32.40	0.00	48.86	54.00	-5.14	1/3MHz	RB	RB
PK	H	7437.000	45.81	35.78	11.18	32.19	0.00	60.59	74.00	-13.41	1/3MHz	RB	RB
AVG	H	7437.000	31.91	35.78	11.18	32.19	0.00	46.69	54.00	-7.31	1/3MHz	RB	RB
PK, NF	H	9916.000	29.70	37.10	13.48	29.82	0.00	50.47	87.59	-37.12	100/300kHz		
AVG, NF	H	9916.000	15.80	37.10	13.48	29.82	0.00	36.57	67.59	-31.02	100/300kHz		
PK, NF	H	12395.000	39.91	39.21	14.66	32.22	0.00	61.56	74.00	-12.44	1/3MHz	RB	RB
AVG, NF	H	12395.000	26.01	39.21	14.66	32.22	0.00	47.66	54.00	-6.34	1/3MHz	RB	RB
PK, NF	H	14874.000	28.50	39.80	15.66	30.22	0.00	53.74	87.59	-33.85	100/300kHz		
AVG, NF	H	14874.000	14.60	39.80	15.66	30.22	0.00	39.84	67.59	-27.75	100/300kHz		
PK, NF	H	17353.000	31.31	42.07	20.74	32.27	0.00	61.85	87.59	-25.74	100/300kHz		
AVG, NF	H	17353.000	17.41	42.07	20.74	32.27	0.00	47.95	67.59	-19.64	100/300kHz		

Hand scan testing - 15-18 GHz, test equipment used: ETS002, 145014, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

Handscan testing - 18-25 GHz, test equipment used: EMC04, REA006, PRE9, CBLHF2012-2M-2, CBLHF2012-2M-1, REA004, ROS001.
 No emissions were detected

2465 MHz Antenna Port Conducted Emissions

2465 MHz Antenna Port Conducted Emissions (3-25 GHz)

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: N/A
 Serial #: Prototype Cable(s): CBL030 NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: DAV004 Filter: REA004
 Project #: G101602013 Date(s): 04/16/14 Temp/Humidity/Pressure: REA006
 Standard: FCC Part 15 Subpart C 15.247
 Receiver: ROS001 Limit Distance (m): N/A
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): N/A
 PreAmp Used? (Y or N): N Voltage/Frequency: Laptop USB Powered Frequency Range: 3-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
2465MHz Conducted Spurious, CBL030, ROS001, REA004 (3-18GHz), Antenna gain = -0.2d Bi													
EIRP Reading includes antenna gain of -0.2 dBi (dBm)													
PK	--	4930.000	-50.86	0.00	1.99	0.00	0.00	-49.07	--	--	1/3 MHz	RB	RB
PK, NF	--	7395.000	-66.00	0.00	2.52	0.00	0.00	-63.68	--	--	1/3 MHz	RB	RB
PK, NF	--	12325.000	-65.00	0.00	3.57	32.25	0.00	-93.88	--	--	1/3 MHz	RB	RB
Conversion from EIRP to field strength, E = EIRP - 20LOG(D) +104.8 (dBuV/m), at 3 meters													
PK	--	4930.000	0.00	0.00	0.00	0.00	0.00	46.19	54.00	-7.81	1/3 MHz	RB	RB
PK, NF	--	7395.000	0.00	0.00	0.00	0.00	0.00	31.58	54.00	-22.42	1/3 MHz	RB	RB
PK, NF	--	12325.000	0.00	0.00	0.00	0.00	0.00	1.37	54.00	-52.63	1/3 MHz	RB	RB
18-25 GHz used REA006 - No emissions were detected. Took plot													

Notes: No emissions were detected from 30MHz-3GHz, see plot.

2471 MHz Antenna Port Conducted Emissions

2471 MHz Antenna Port Conducted Emissions (3-25 GHz)

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: N/A
 Serial #: Prototype Cable(s): CBL030 NONE.
 Engineers: Kouma Sinn Location: EMC Lab Barometer: DAV004 Filter: REA004
 Project #: G101602013 Date(s): 04/16/14 Temp/Humidity/Pressure: REA006
 Standard: FCC Part 15 Subpart C 15.247
 Receiver: ROS001 Limit Distance (m): N/A
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): N/A
 PreAmp Used? (Y or N): N Voltage/Frequency: Laptop USB Powered Frequency Range: 3-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
2471MHz Conducted Spurious, CBL030, ROS002, REA004 (3-18GHz), Antenna gain = -0.2dBi													
EIRP Reading includes antenna gain of -0.2 dBi (dBm)													
PK	--	4942.000	-43.89	0.00	1.99	0.00	0.00	-42.10	--	--	1/3MHz	RB	RB
PK, NF	--	7413.000	-66.34	0.00	2.52	0.00	0.00	-64.02	--	--	1/3MHz	RB	RB
PK, NF	--	12355.000	-65.72	0.00	3.57	0.00	0.00	-62.35	--	--	1/3MHz	RB	RB
Conversion from EIRP to field strength, E = EIRP - 20LOG(D) +104.8 (dBuV/m), at 3 meters													
PK	--	4942.000	0.00	0.00	0.00	0.00	0.00	53.16	54.00	-0.84	1/3MHz	RB	RB
PK, NF	--	7413.000	0.00	0.00	0.00	0.00	0.00	31.24	54.00	-22.76	1/3MHz	RB	RB
PK, NF	--	12355.000	0.00	0.00	0.00	0.00	0.00	32.91	54.00	-21.09	1/3MHz	RB	RB
18-25 GHz used REA006 - No emissions were detected. Took plot													

Notes: No emissions were detected from 30MHz-3GHz, see plot.

2473 MHz Antenna Port Conducted Emissions

2473 MHz Antenna Port Conducted Emissions (3-25 GHz)

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: N/A
 Serial #: Prototype Cable(s): CBL030 NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: DAV004 Filter: REA004
 Project #: G101602013 Date(s): 04/16/14 Temp/Humidity/Pressure: REA006
 Standard: FCC Part 15 Subpart C 15.247
 Receiver: ROS001 Limit Distance (m): N/A
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): N/A
 PreAmp Used? (Y or N): N Voltage/Frequency: Laptop USB Powered Frequency Range: 3-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
2473MHz Conducted Spurious, CBL030, ROS001, REA004 (3-18GHz), Antenna gain = -0.2dBi													
EIRP Reading includes antenna gain of -0.2 dBi (dBm)													
PK	--	4946.000	-43.90	0.00	1.99	0.00	0.00	-42.11	--	--	1/3MHz	RB	RB
PK, NF	--	7419.000	-65.88	0.00	2.53	0.00	0.00	-63.55	--	--	1/3MHz	RB	RB
PK, NF	--	12365.000	-65.42	0.00	3.57	0.00	0.00	-62.05	--	--	1/3MHz	RB	RB
Conversion from EIRP to field strength, E = EIRP - 20LOG(D) +104.8 (dBuV/m), at 3 meters													
PK	--	4946.000	0.00	0.00	0.00	0.00	0.00	53.15	54.00	-0.85	1/3MHz	RB	RB
PK, NF	--	7419.000	0.00	0.00	0.00	0.00	0.00	31.70	54.00	-22.30	1/3MHz	RB	RB
PK, NF	--	12365.000	0.00	0.00	0.00	0.00	0.00	33.21	54.00	-20.79	1/3MHz	RB	RB
18-25 GHz used REA006 - No emissions were detected. Took plot													

Notes: No emissions were detected from 30MHz-3GHz, see plot.

2479 MHz Antenna Port Conducted Emissions

2479 MHz Antenna Port Conducted Emissions (3-25 GHz)

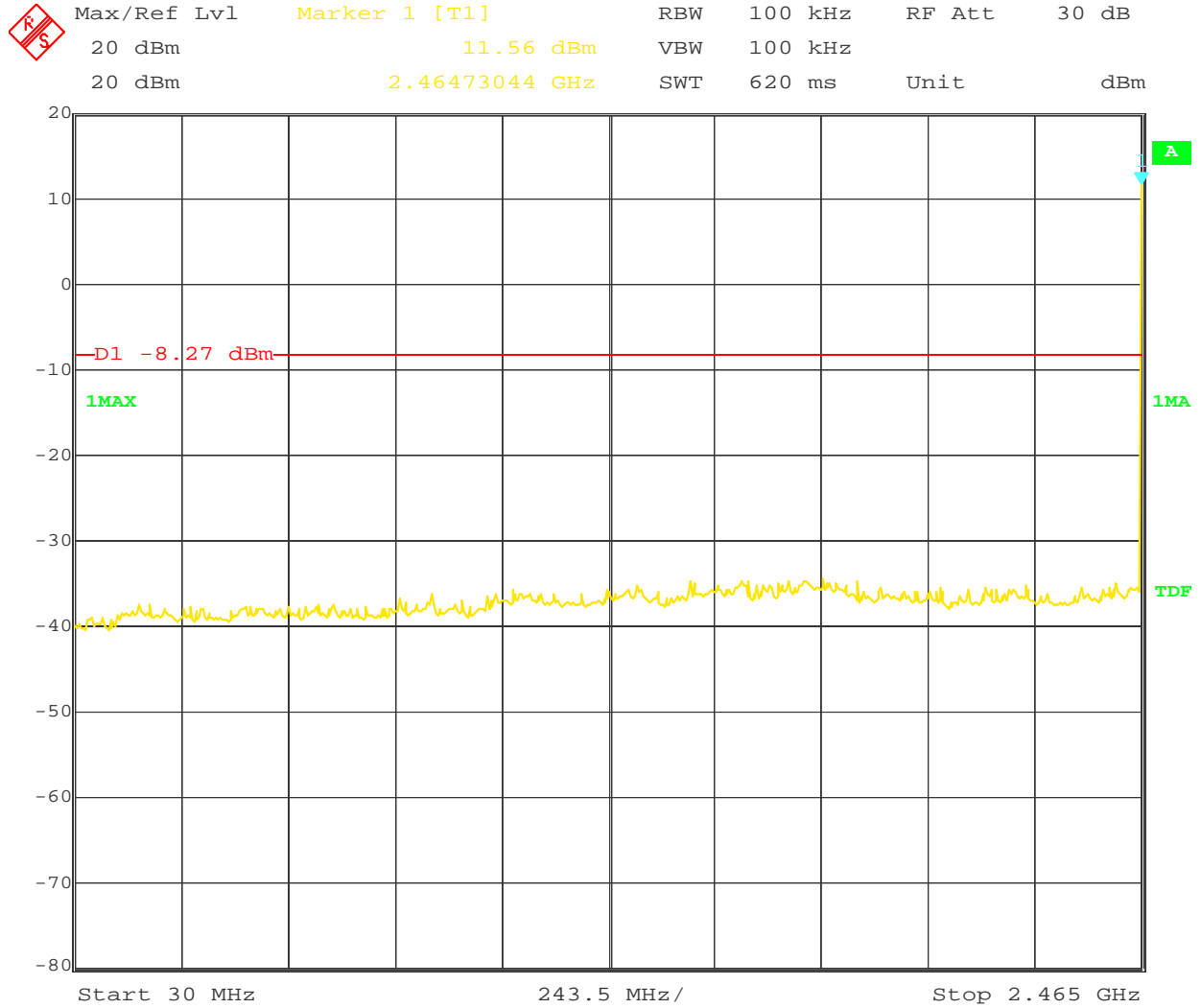
Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: N/A
 Serial #: Prototype Cable(s): CBL030 NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: DAV004 Filter: REA004
 Project #: G101602013 Date(s): 04/16/14 Temp/Humidity/Pressure: REA006
 Standard: FCC Part 15 Subpart C 15.247
 Receiver: ROS001 Limit Distance (m): N/A
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): N/A
 PreAmp Used? (Y or N): N Voltage/Frequency: Laptop USB Powered Frequency Range: 3-25 GHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
2479MHz Conducted Spurious, CBL030, ROS001, REA004 (3-18GHz), Antenna gain = -0.2dBi													
EIRP Reading includes antenna gain of -0.2 dBi (dBm)													
PK	--	4958.000	-46.14	0.00	1.99	0.00	0.00	-44.35	Out of Band	#VALUE!	1/3MHz	RB	RB
PK, NF	--	7437.000	-65.66	0.00	2.53	0.00	0.00	-63.33	Out of Band	#VALUE!	1/3MHz	RB	RB
PK, NF	--	12395.000	-66.49	0.00	3.58	0.00	0.00	-63.11	Out of Band	#VALUE!	1/3MHz	RB	RB
Conversion from EIRP to field strength, E = EIRP - 20LOG(D) +104.8 (dBuV/m), at 3 meters													
PK	--	4958.000	0.00	0.00	0.00	0.00	0.00	50.91	54.00	-3.09	1/3MHz	RB	RB
PK, NF	--	7437.000	0.00	0.00	0.00	0.00	0.00	32.00	54.00	-22.00	1/3MHz	RB	RB
PK, NF	--	12395.000	0.00	0.00	0.00	0.00	0.00	32.15	54.00	-21.85	1/3MHz	RB	RB
18-25 GHz used REA006 - No emissions were detected. Took plot													

Notes: No emissions were detected from 30MHz-3GHz, see plot.

2465 MHz Antenna Port Conducted Emissions

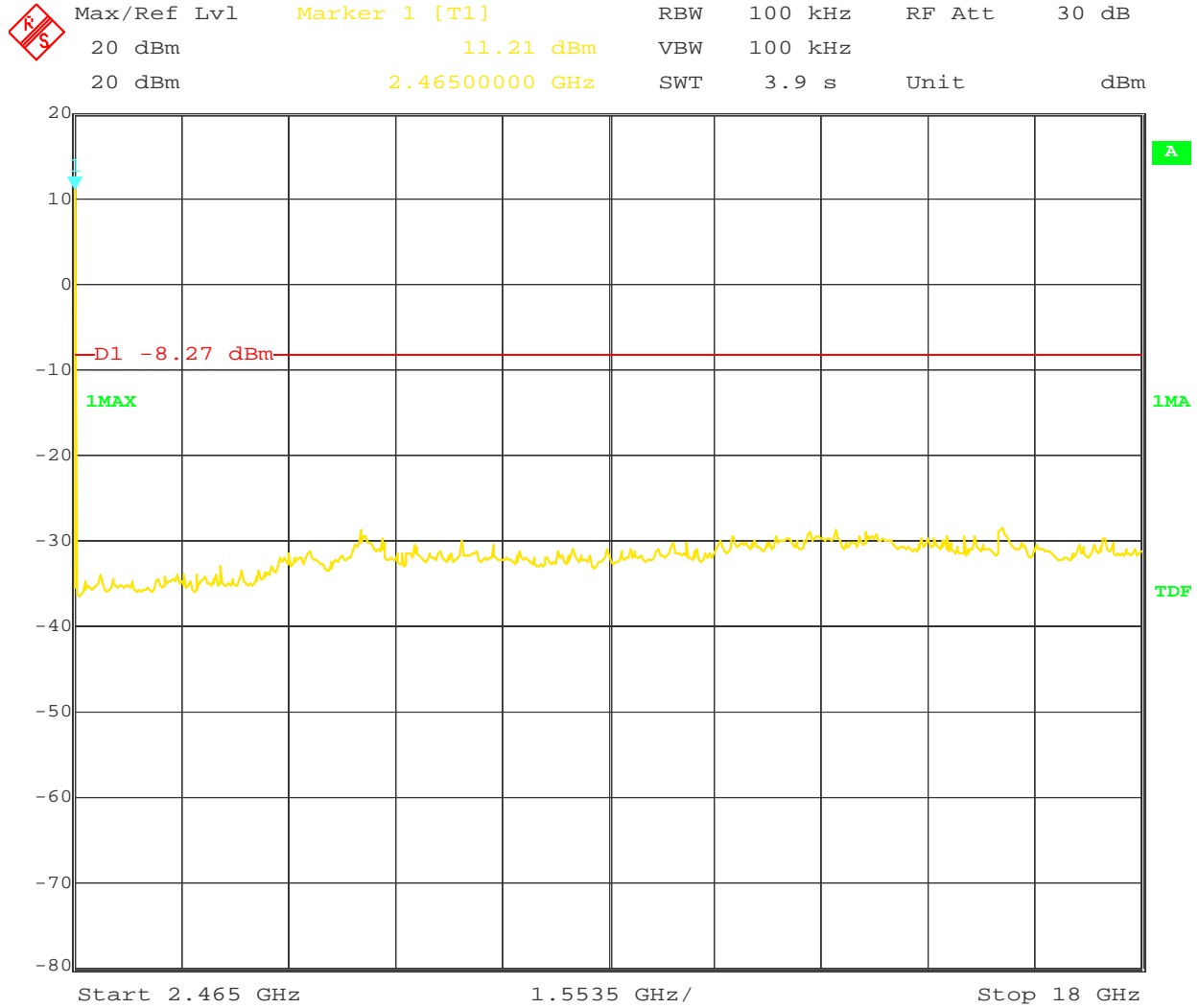
30-2465 MHz



Date: 16.APR.2014 14:51:38

2465 MHz Antenna Port Conducted Emissions

2.465-18 GHz



Date: 16.APR.2014 14:55:14

2465 MHz Antenna Port Conducted Emissions

18-25 GHz



Max/Ref Lvl

Marker 1 [T1]

RBW

1 MHz

RF Att

10 dB

0 dBm

-62.07 dBm

VBW

3 MHz

0 dBm

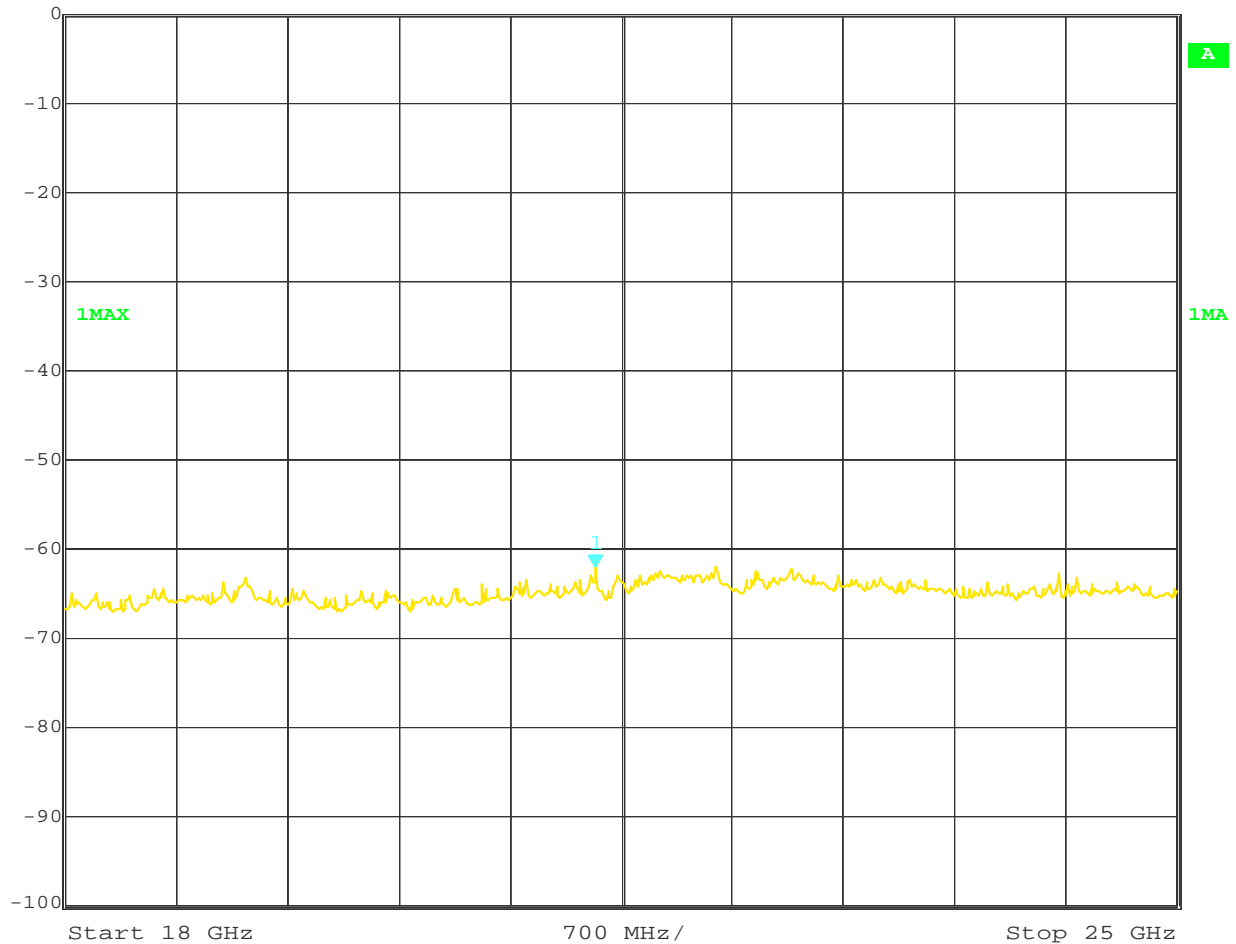
21.33867735 GHz

SWT

70 ms

Unit

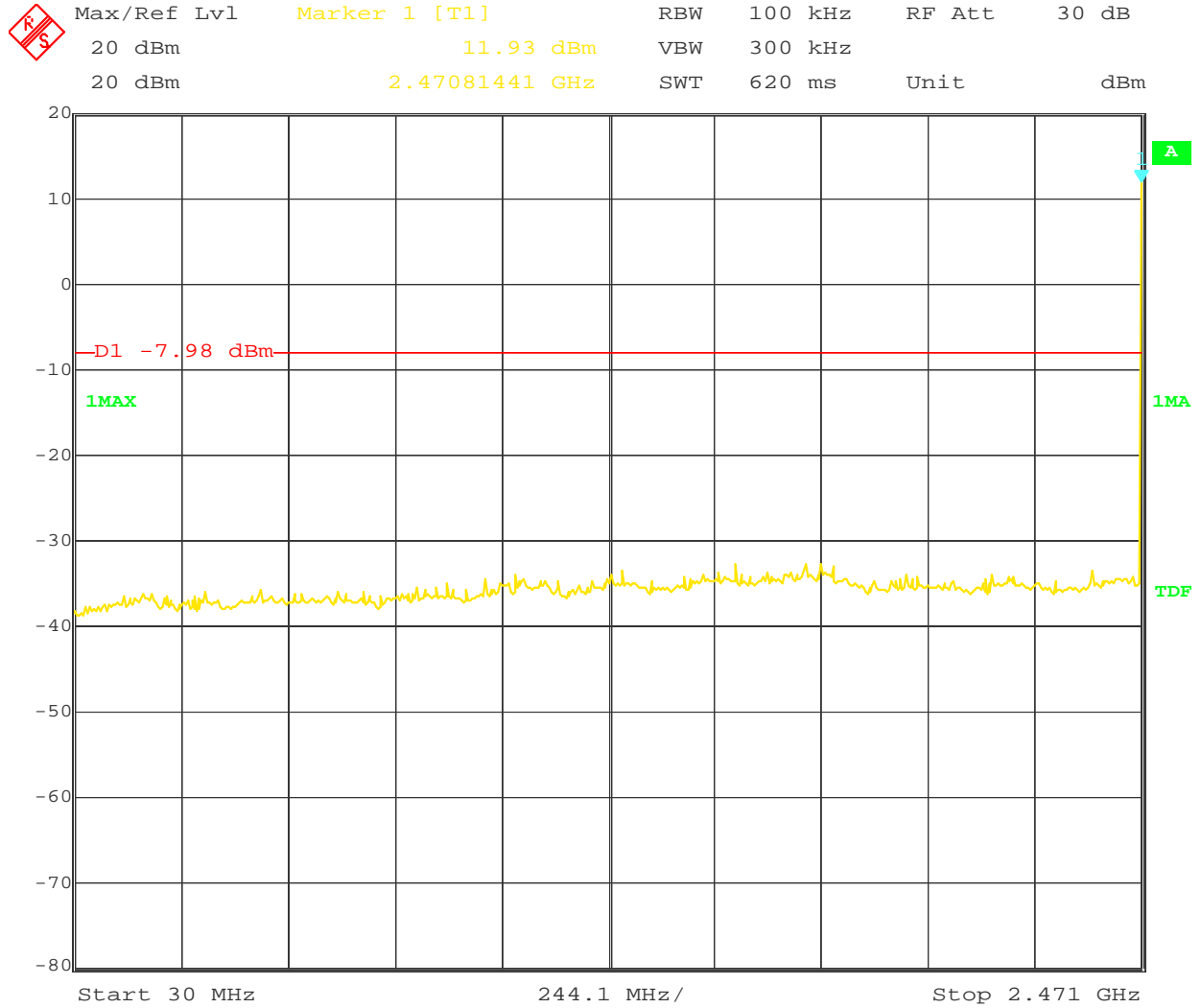
dBm



Date: 16.APR.2014 15:43:14

2471 MHz Antenna Port Conducted Emissions

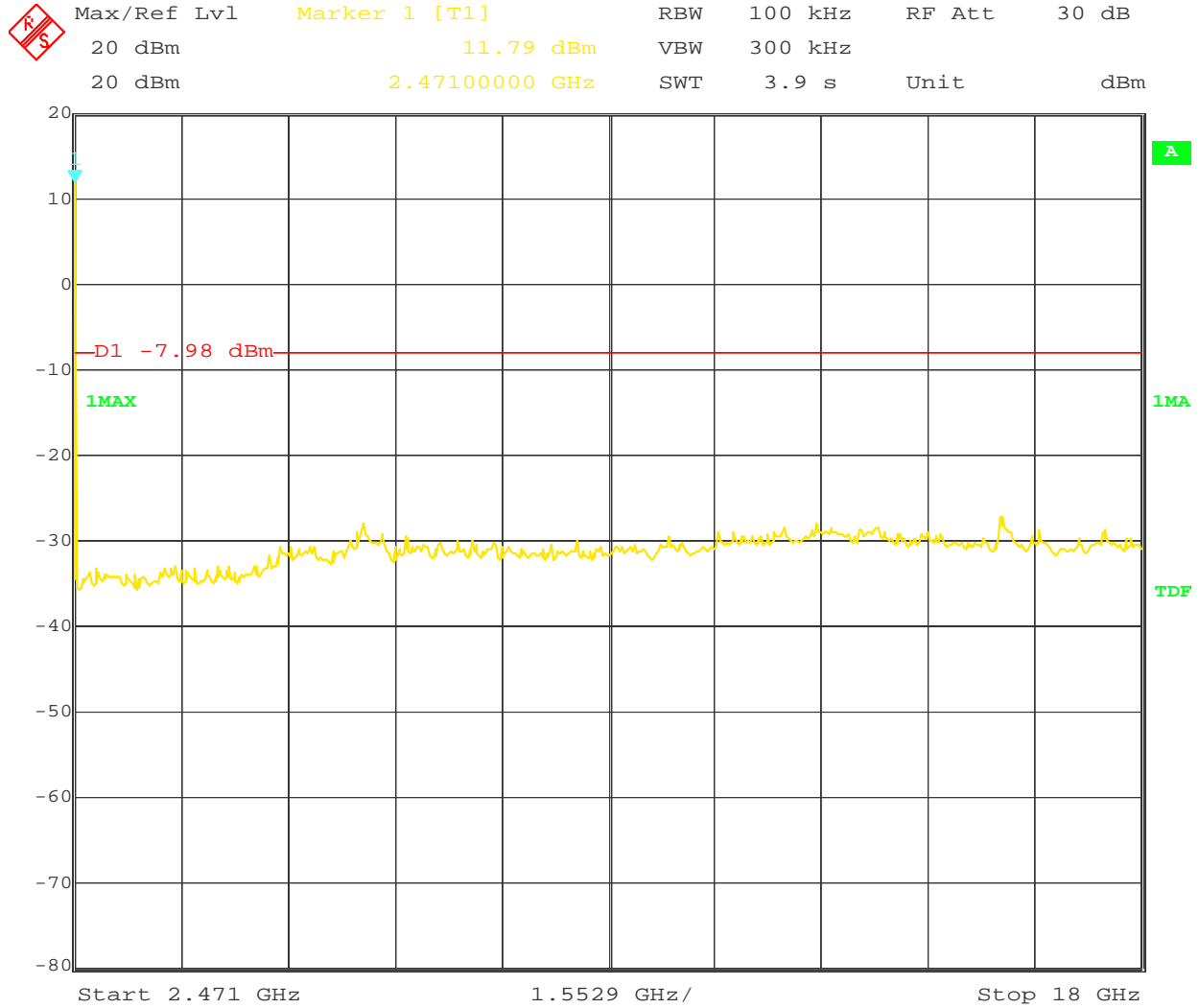
30-2471 MHz



Date: 16.APR.2014 16:08:01

2471 MHz Antenna Port Conducted Emissions

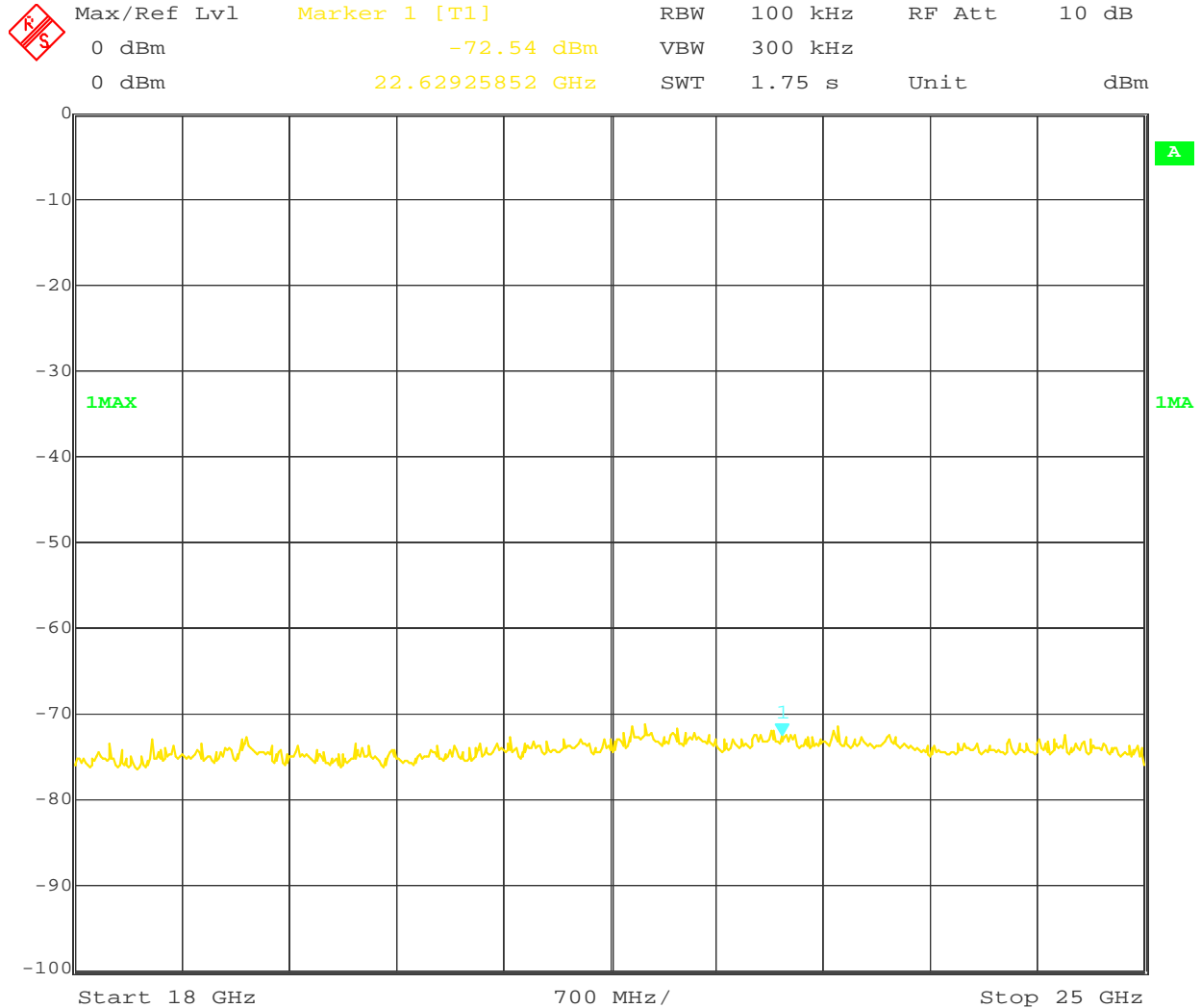
2.471-18 GHz



Date: 16.APR.2014 16:10:33

2471 MHz Antenna Port Conducted Emissions

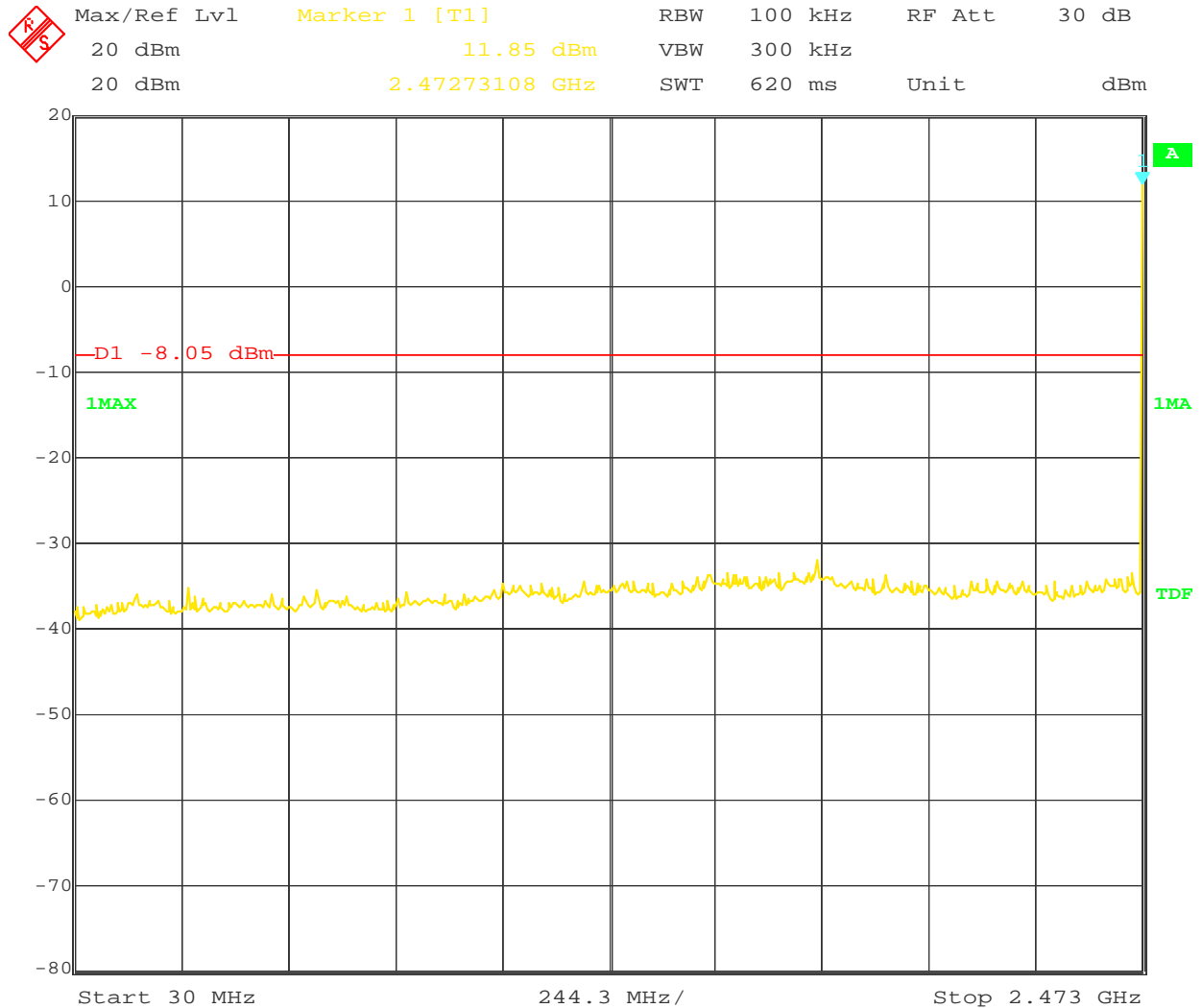
18-25 GHz



Date: 16.APR.2014 16:36:10

2473 MHz Antenna Port Conducted Emissions

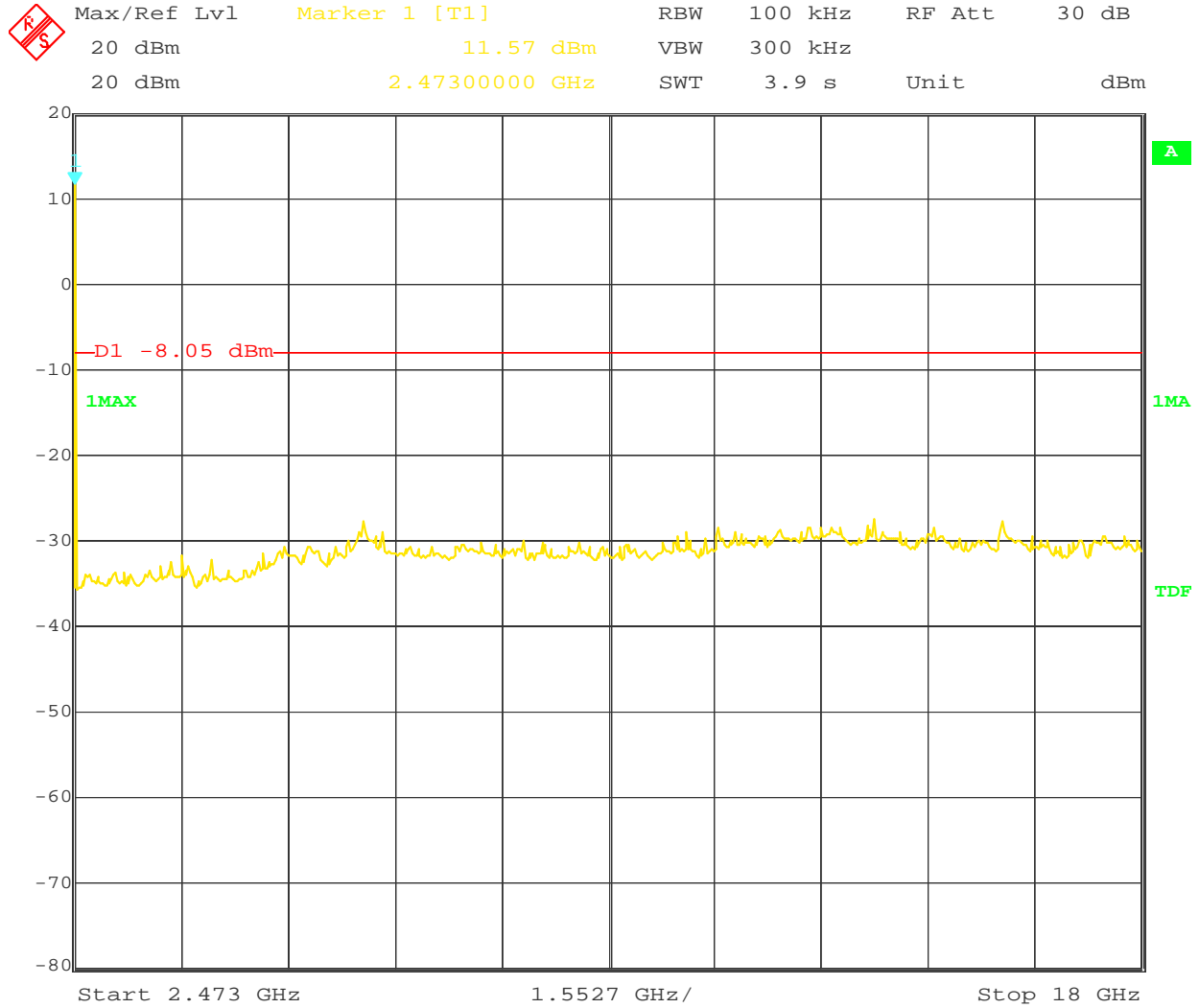
30-2473 MHz



Date: 16.APR.2014 16:48:31

2473 MHz Antenna Port Conducted Emissions

2.473-18 GHz



Date: 16.APR.2014 16:50:43

2473 MHz Antenna Port Conducted Emissions

18-25 GHz



Max/Ref Lvl

Marker 1 [T1]

RBW

100 kHz

RF Att

10 dB

0 dBm

-71.57 dBm

VBW

300 kHz

0 dBm

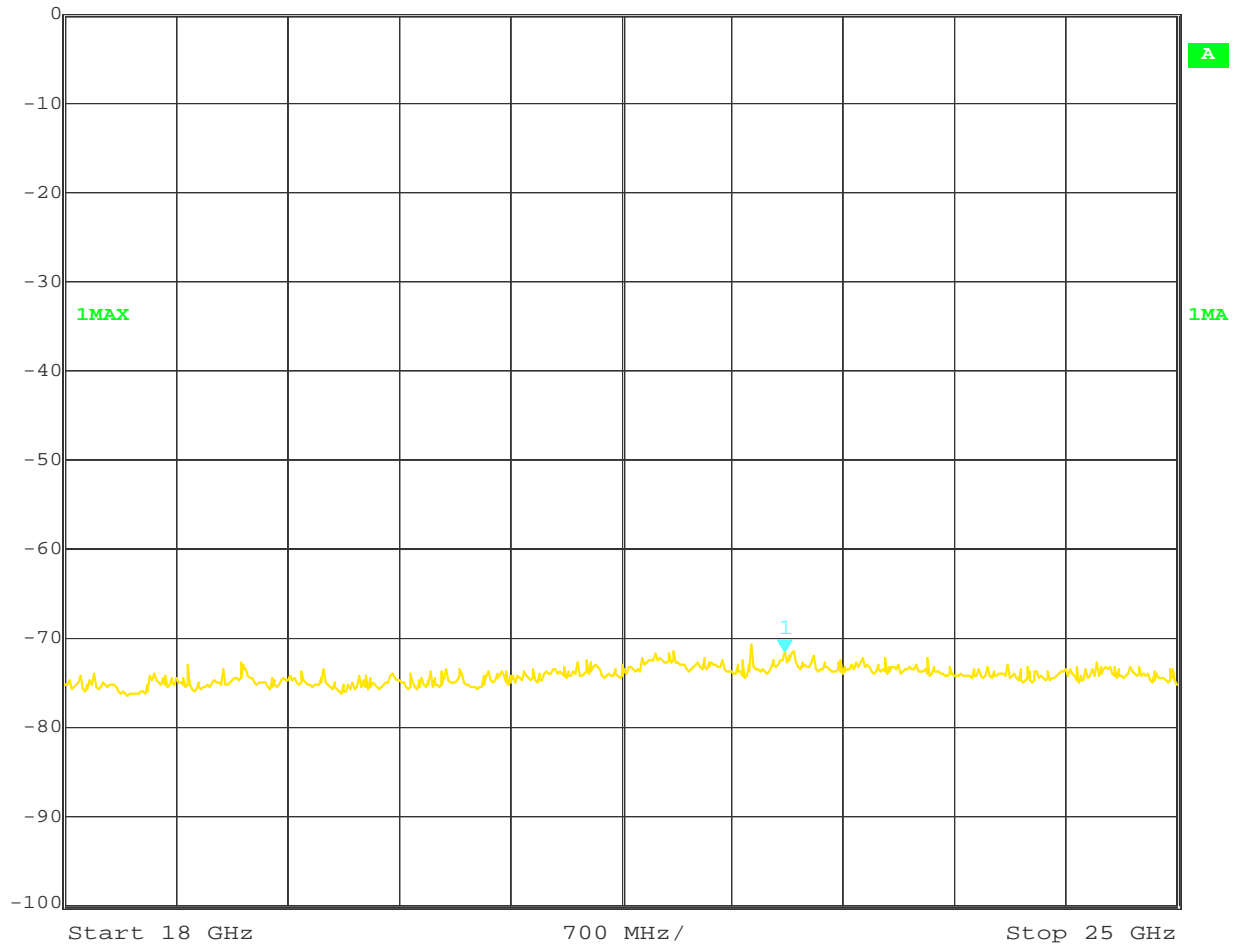
22.53106212 GHz

SWT

1.75 s

Unit

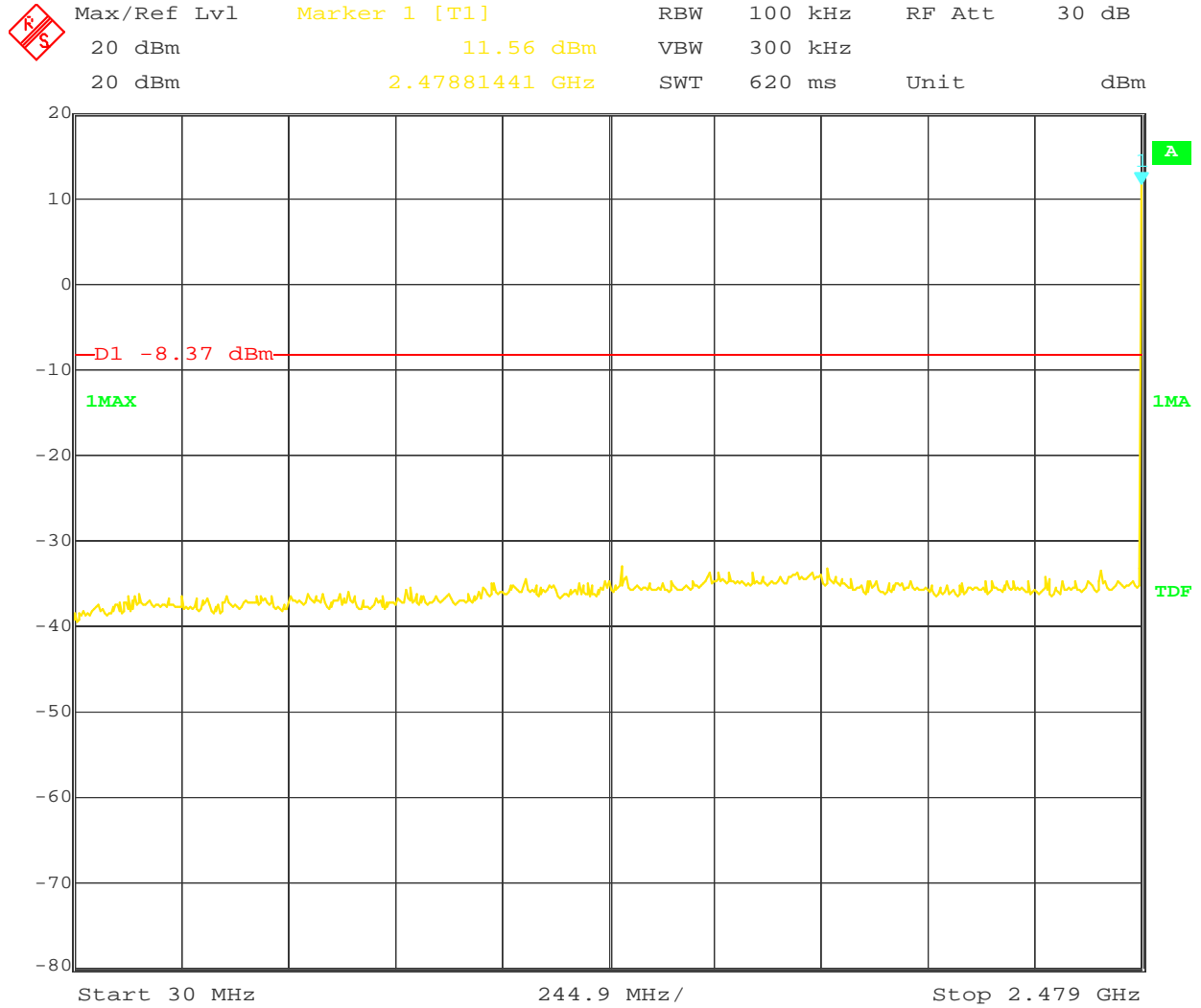
dBm



Date: 16.APR.2014 17:09:30

2479 MHz Antenna Port Conducted Emissions

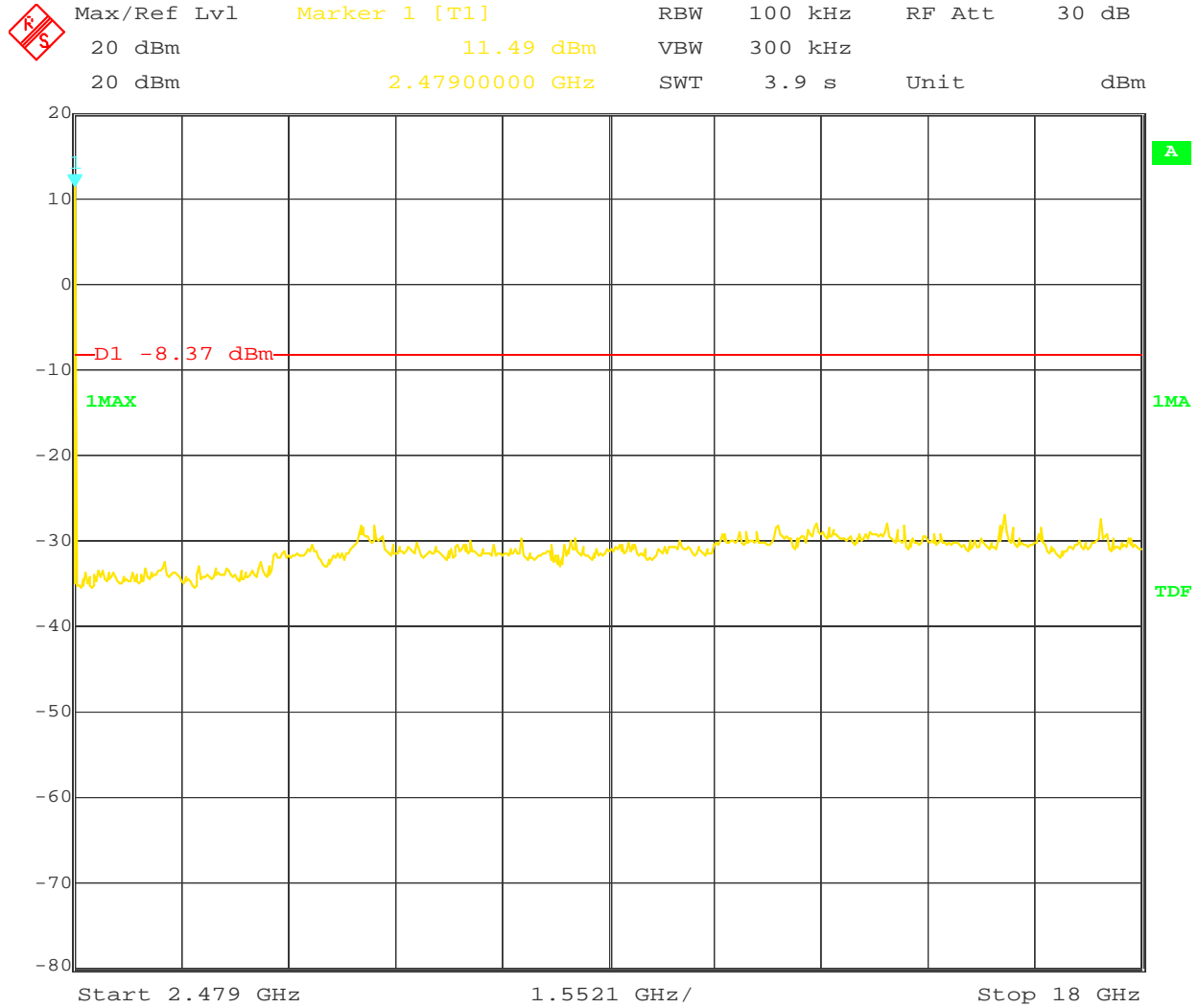
30-2479 MHz



Date: 16.APR.2014 17:18:45

2479 MHz Antenna Port Conducted Emissions

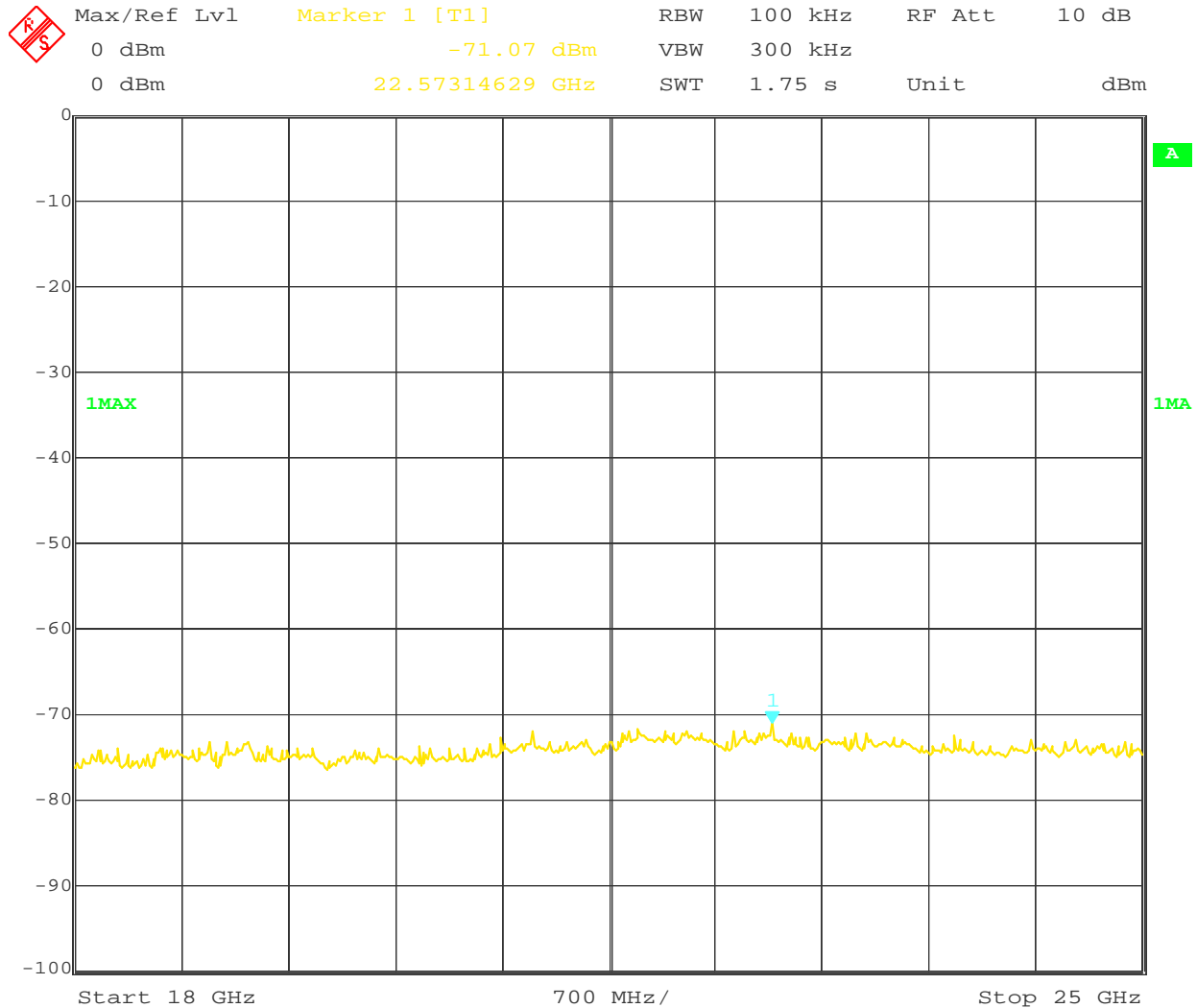
2.479-18 GHz



Date: 16.APR.2014 17:21:04

2479 MHz Antenna Port Conducted Emissions

18-25 GHz



Date: 16.APR.2014 17:45:06

Test Personnel: Kouma Sinn *KPS*
Supervising/Reviewing Engineer:
(Where Applicable) N/A

Product Standard: FCC Part 15.247,
RSS-210 Annex 8
Input Voltage: USB Powered
Pretest Verification w/
Ambient Signals or
BB Source: Ambient Signals

Test Date: 04/10/2014, 04/16/2014,
04/17/2014

Limit Applied: Emissions below the limits
specified in Section 7.3

Ambient Temperature: 22, 19, 19 °C

Relative Humidity: 23, 32, 34 %

Atmospheric Pressure: 1007, 1006, 1014 mbars

Deviations, Additions, or Exclusions: None

8 6 dB Bandwidth & 99% Power Bandwidth

8.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10:2009, and RSS-210 Annex 8.

TEST SITE: EMC Lab

The EMC Lab has two Semi-anechoic Chambers and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV004	Weather Station	Davis Instruments	7400	PE80529A61A	09/25/2012	09/25/2014
ROS001	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	04/25/2013	05/02/2014
WEI18	20 dB, Attenuator DC-18GHz	Weinschel Corp	47-20-34	BP0570	03/26/2014	03/26/2015
CBL030	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	04/05/2014	04/05/2015
145128	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/17/2014	03/17/2015

Software Utilized:

Name	Manufacturer	Version
None		

8.3 Results:

The sample tested was found to Comply. The 99% power bandwidth, or 6 dB bandwidth, must not be less than 500 kHz.

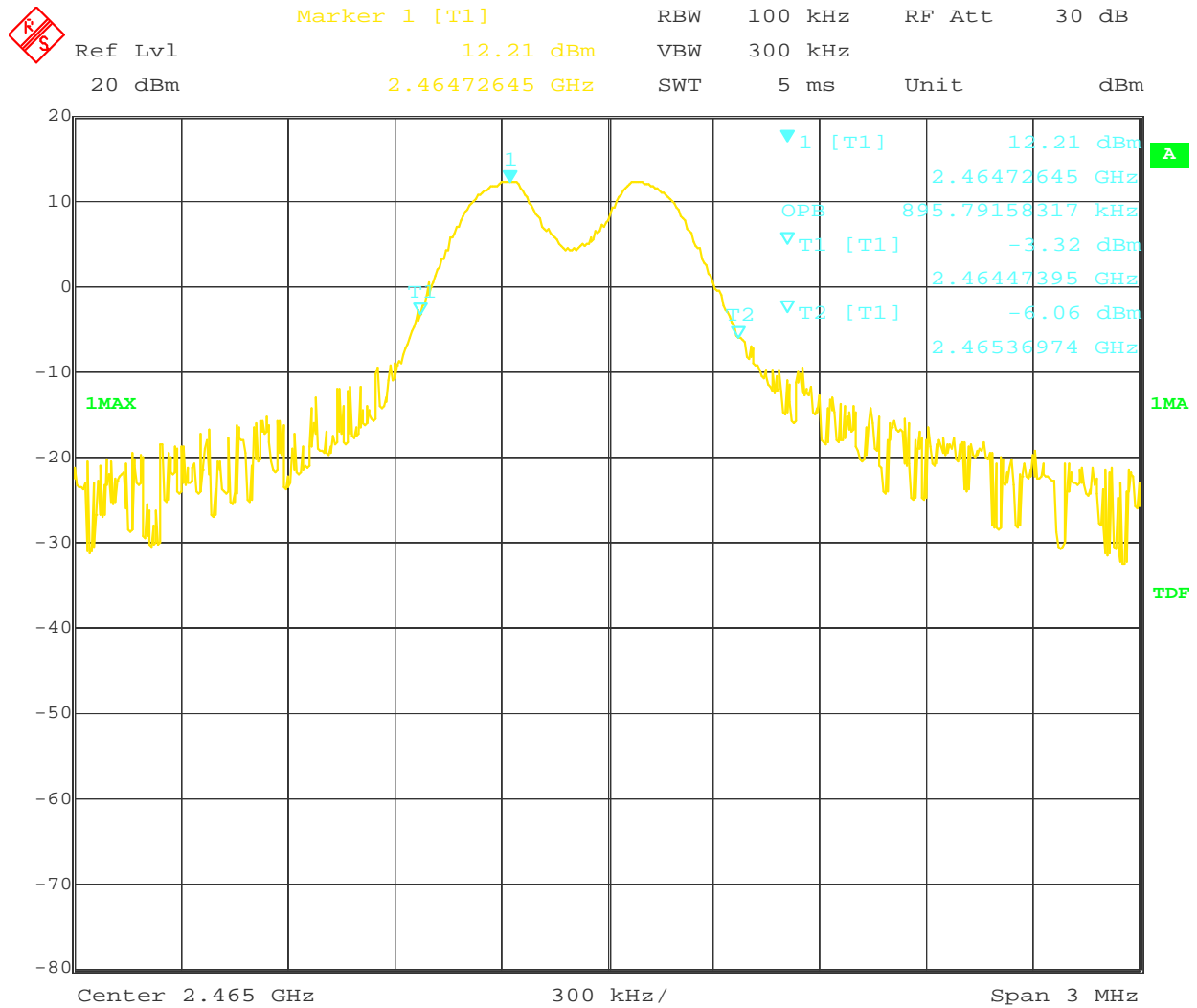
Channels	6 dB Bandwidth	99% Power Bandwidth
2465 MHz	667.334 kHz	895.792 kHz
2471 MHz	661.322 kHz	901.804 kHz
2473 MHz	661.322 kHz	901.804 kHz
2479 MHz	655.311 kHz	919.840 kHz

Plots were taken using a RBW of 100 kHz per KDB 558074v03 04/09/2013 and IC RSS-Gen Section 4.6.2.

8.4 Setup Photograph:

8.5 Plots/Data:

2465 MHz, 99% Power BW – 895.792 kHz

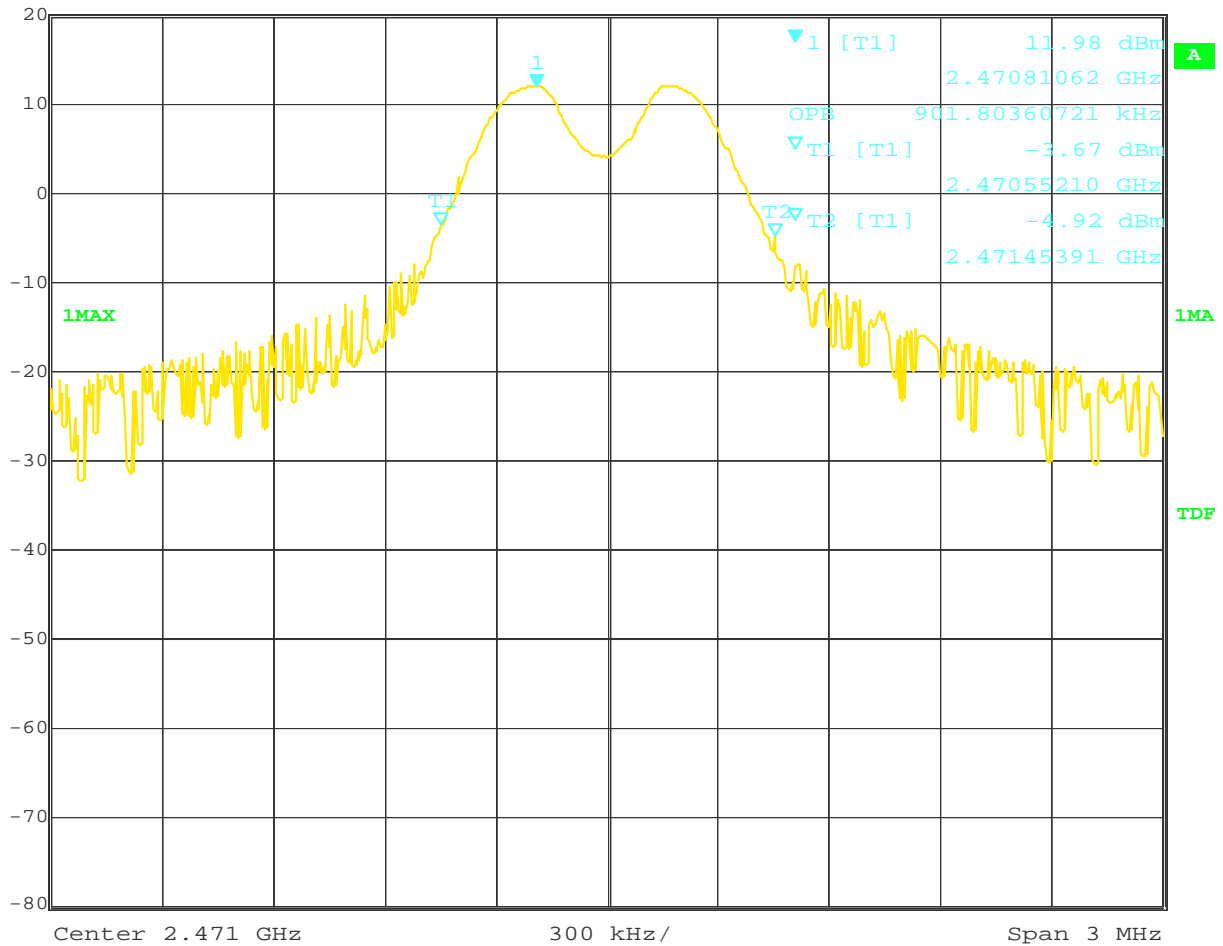


Date: 15.APR.2014 18:15:06

2471 MHz, 99% Power BW – 901.804 kHz

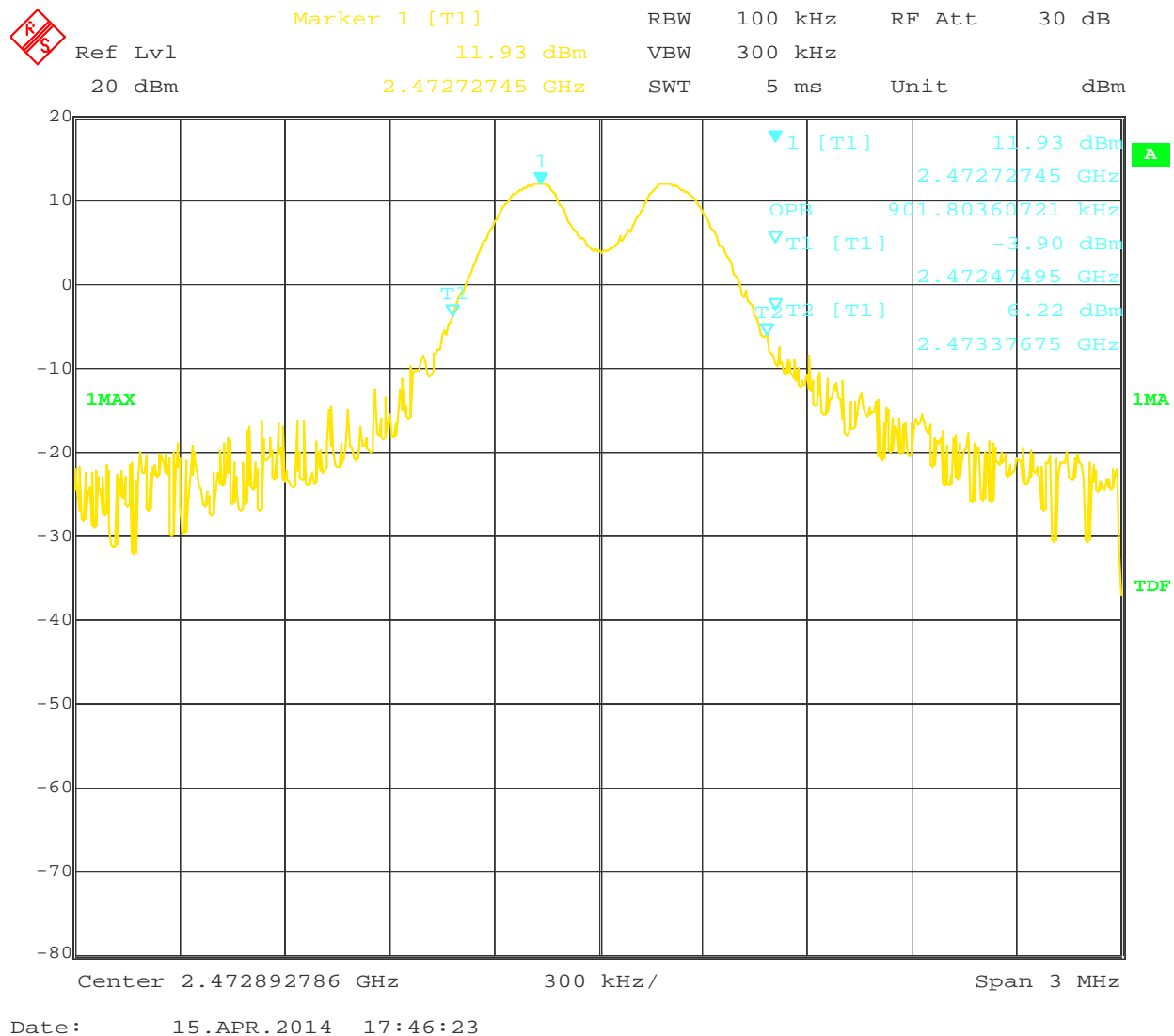


Marker 1 [T1] RBW 100 kHz RF Att 30 dB
 Ref Lvl 11.98 dBm VBW 300 kHz
 20 dBm 2.47081062 GHz SWT 5 ms Unit dBm

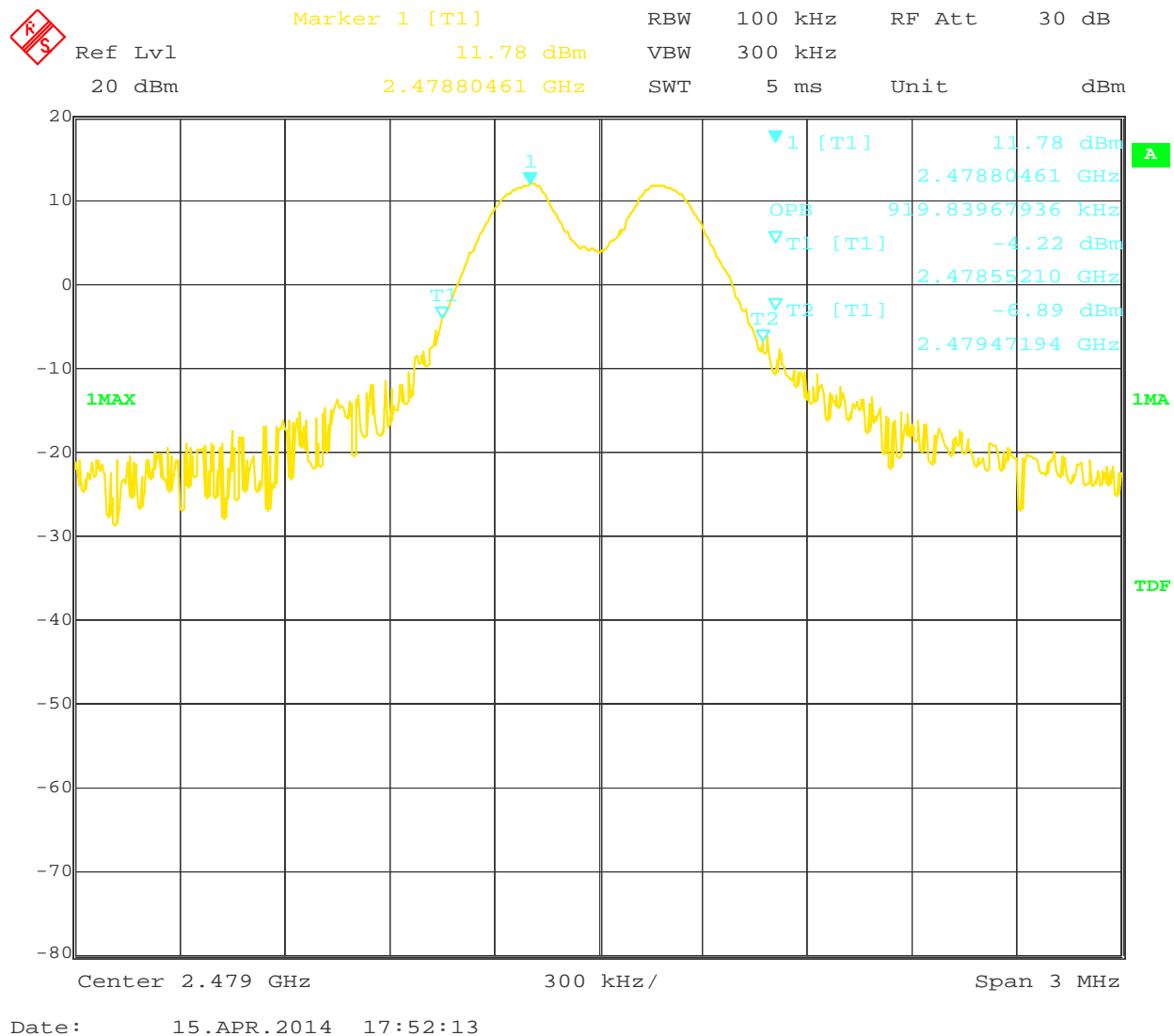


Date: 15.APR.2014 18:32:58

2473 MHz, 99% Power BW – 901.804 kHz



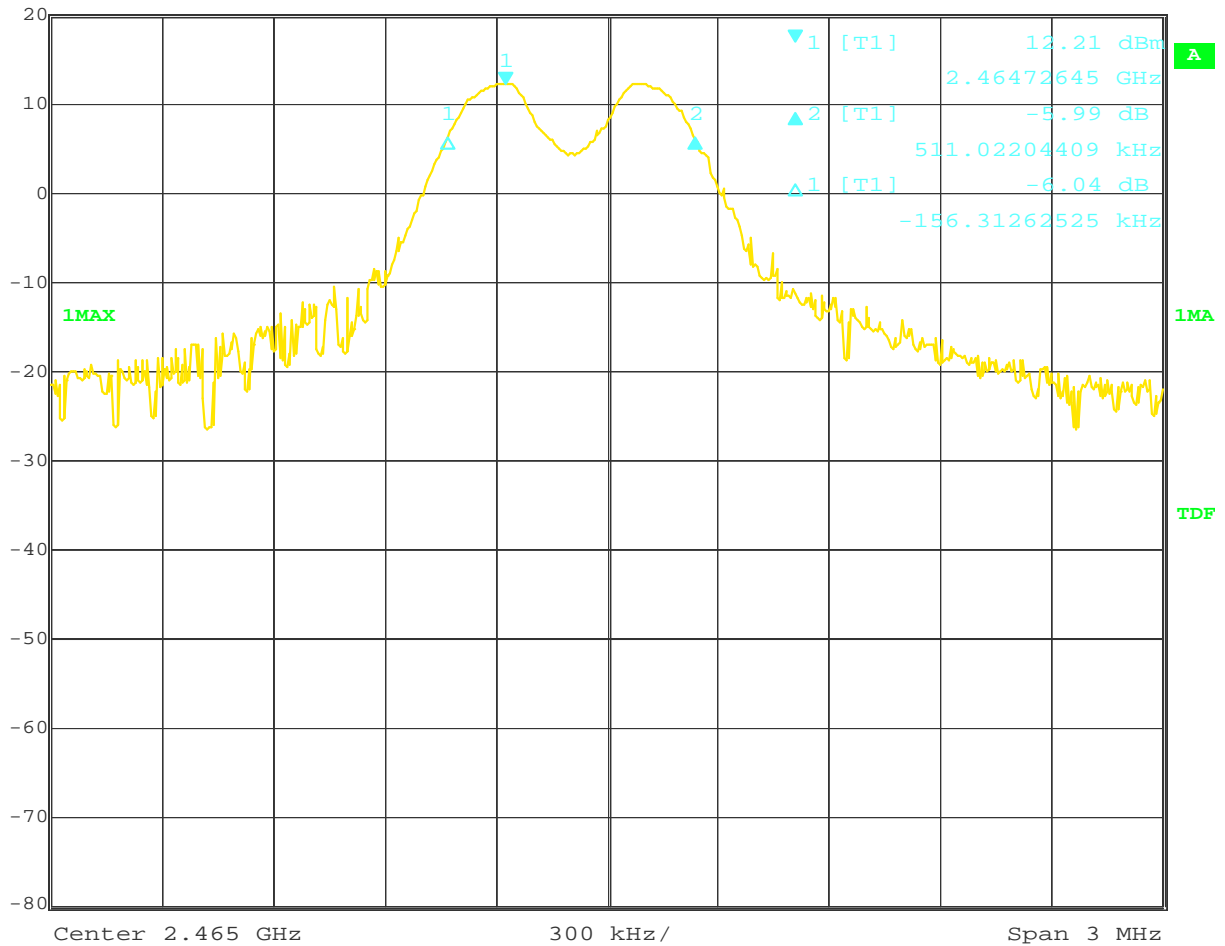
2479 MHz, 99% Power BW – 919.840 MHz



2465 MHz, 6dB BW – 667.334 kHz



Ref Lvl	Delta 2 [T1]	RBW	100 kHz	RF Att	30 dB
20 dBm	-5.99 dB	VBW	300 kHz		
	511.02204409 kHz	SWT	5 ms	Unit	dBm

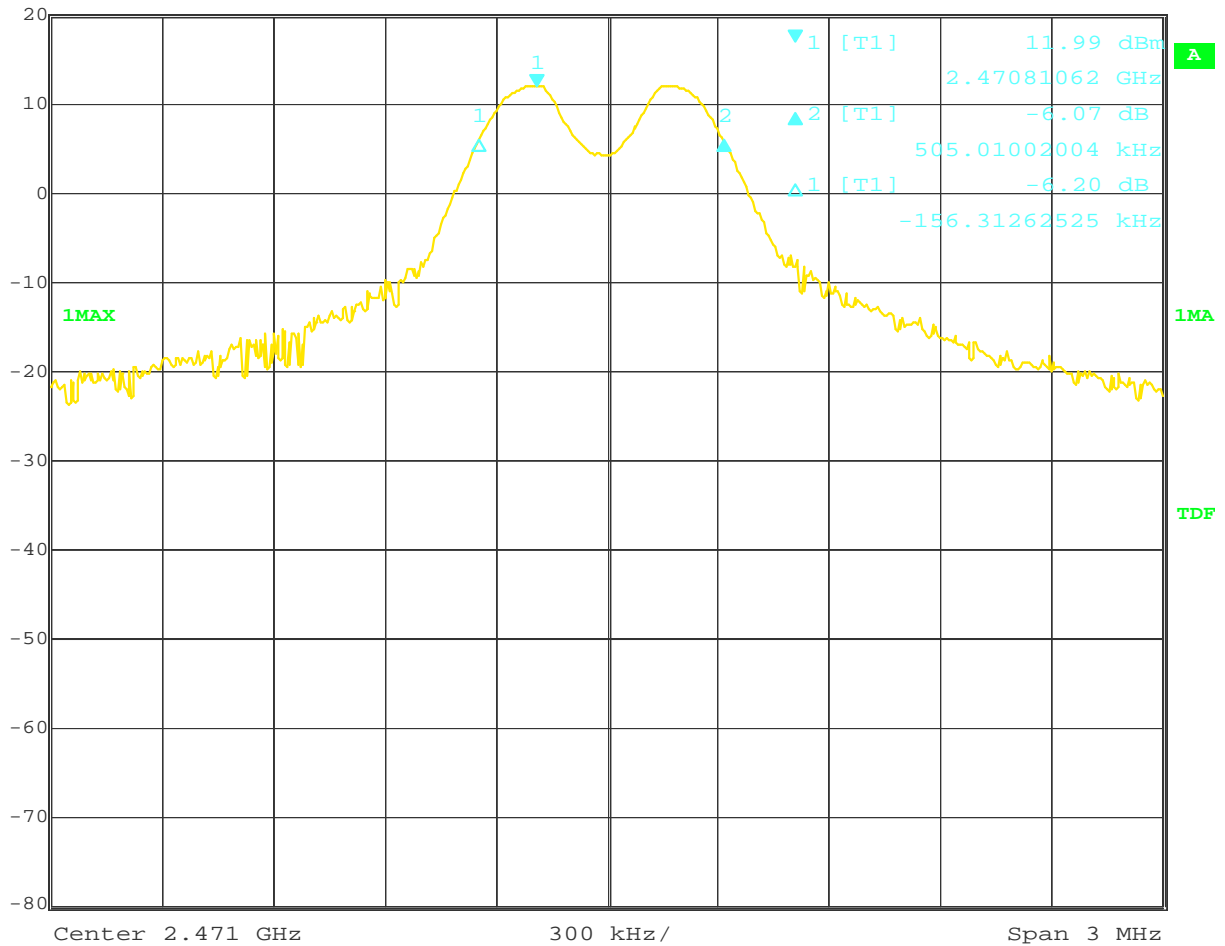


Date: 15.APR.2014 18:12:15

2471 MHz, 6dB BW – 661.322 kHz



Ref Lvl	Delta 2 [T1]	RBW	100 kHz	RF Att	30 dB
20 dBm	-6.07 dB	VBW	300 kHz		
	505.01002004 kHz	SWT	5 ms	Unit	dBm

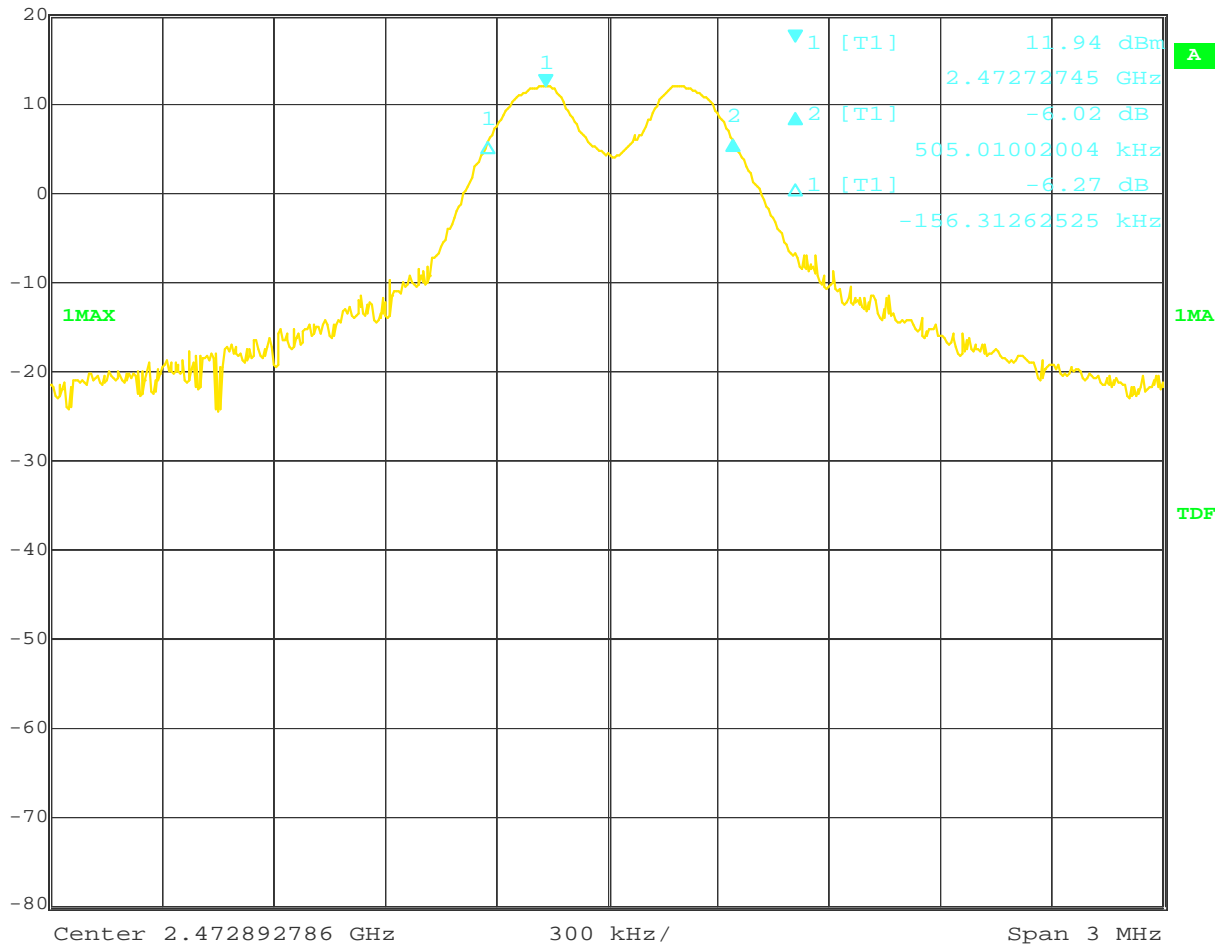


Date: 15.APR.2014 18:30:30

2473 MHz, 6dB BW – 661.322 kHz



Ref Lvl	Delta 2 [T1]	RBW	100 kHz	RF Att	30 dB
20 dBm	-6.02 dB	VBW	300 kHz		
	505.01002004 kHz	SWT	5 ms	Unit	dBm



Date: 15.APR.2014 17:44:04



Unit dBm



Test Date: 04/15/2014

Limit Applied:	Emissions below the limits specified in Section 8.3
Ambient Temperature:	21 °C
Relative Humidity:	56 %
Atmospheric Pressure:	1000 mbars

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9 Power Spectral Density

9.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.10:2009, and RSS-210 Annex 8.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A wooden table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) < U_{CISPR} (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dB μ V/m

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB μ V

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$
$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61A	09/25/2012	09/25/2014
ROS001'	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	04/25/2013	05/02/2014
WEI18'	20 dB, Attenuator DC-18GHz	Weinschel Corp	47-20-34	BP0570	03/26/2014	03/26/2015
CBL030'	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	04/05/2014	04/05/2015
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/17/2014	03/17/2015
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	01/06/2014	01/06/2015
145-416'	Cables 145-400 145-402 145-404 145-408	Huber + Suhner	3m Track B cables	multiple	10/04/2013	10/04/2014
MAN1'	Digital 4 Line Barometer	Mannix	OABA116	MAN1	08/13/2012	08/13/2014

Software Utilized:

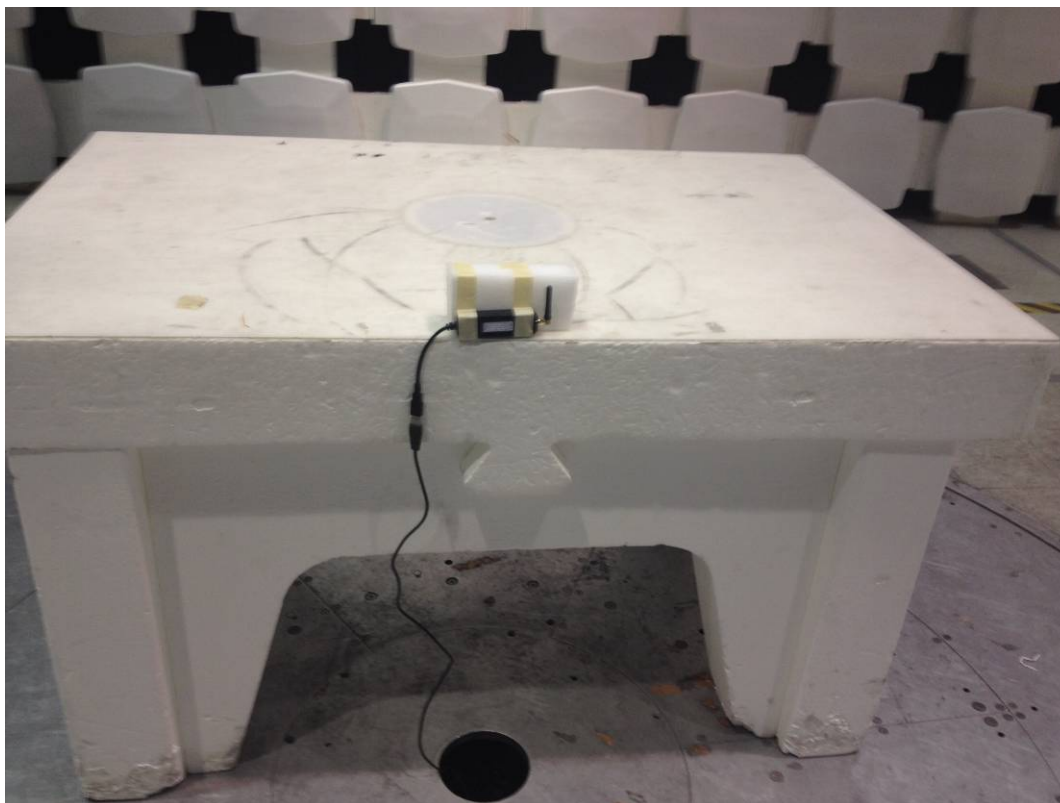
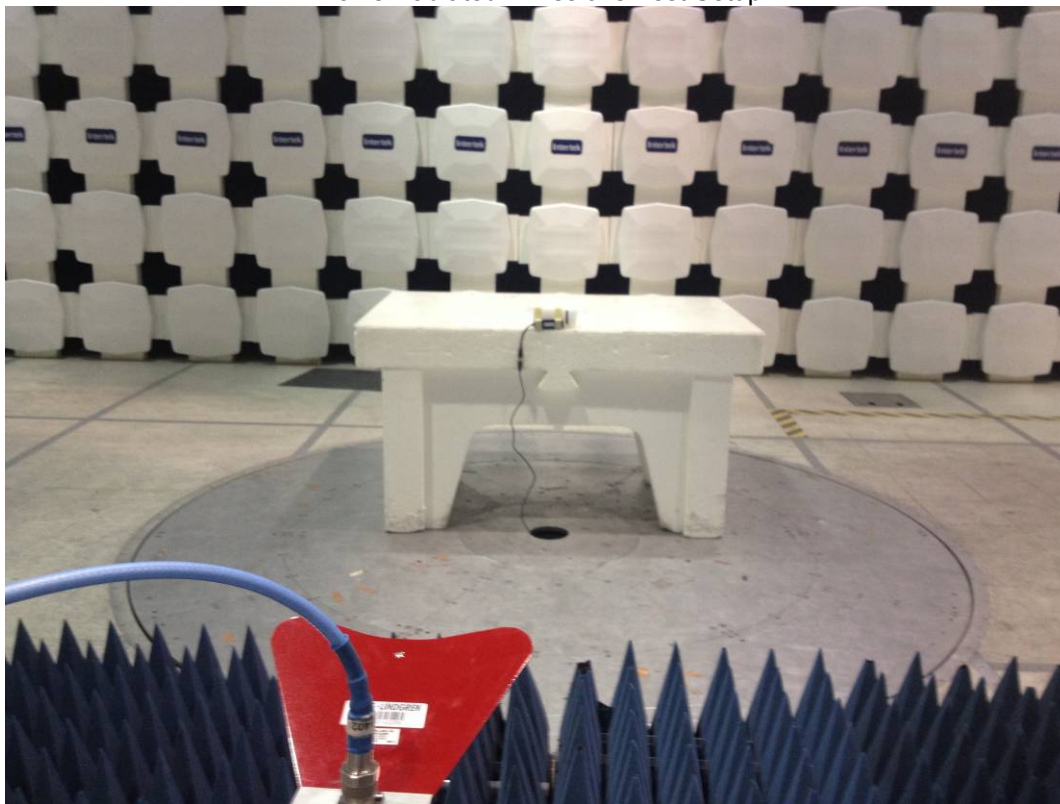
Name	Manufacturer	Version
Excel 2003	Microsoft	(11.8231.8221) SP3
EMI Boxborough.xls	Intertek	08/27/10

9.3 Results:

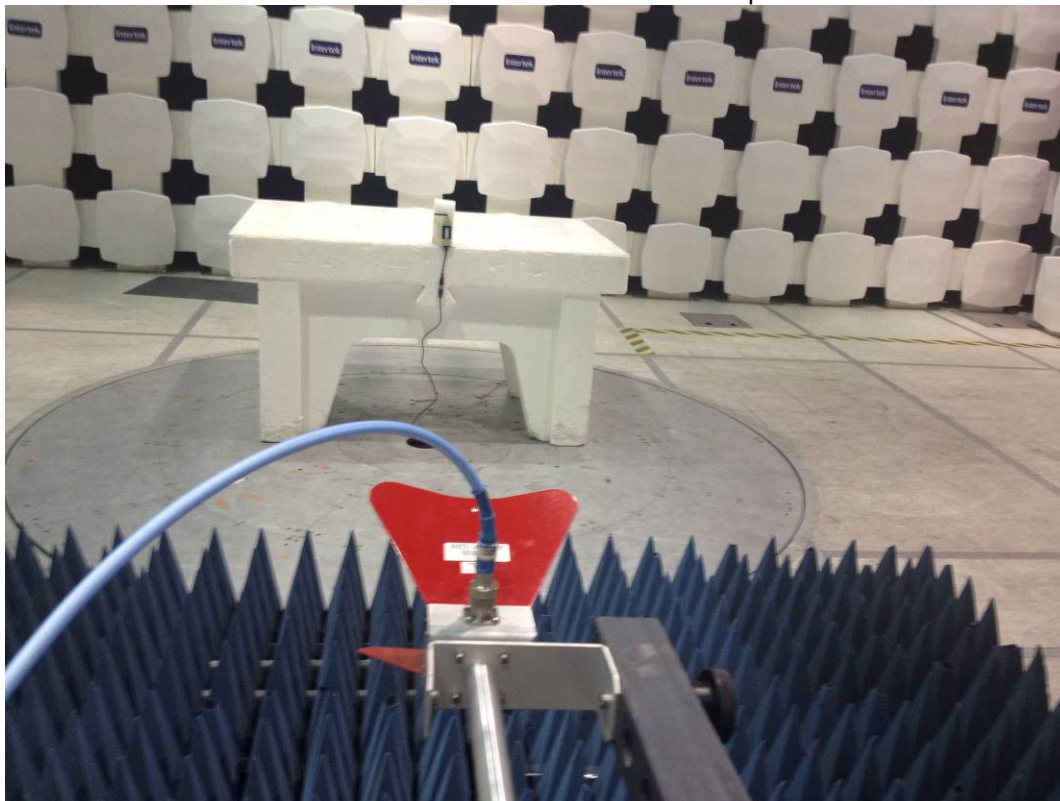
The sample tested was found to Comply. The peak power spectral density must not exceed 8 dBm in any 3 kHz bandwidth using the methods of ANSI C63.10:2009.

9.4 Setup Photographs:

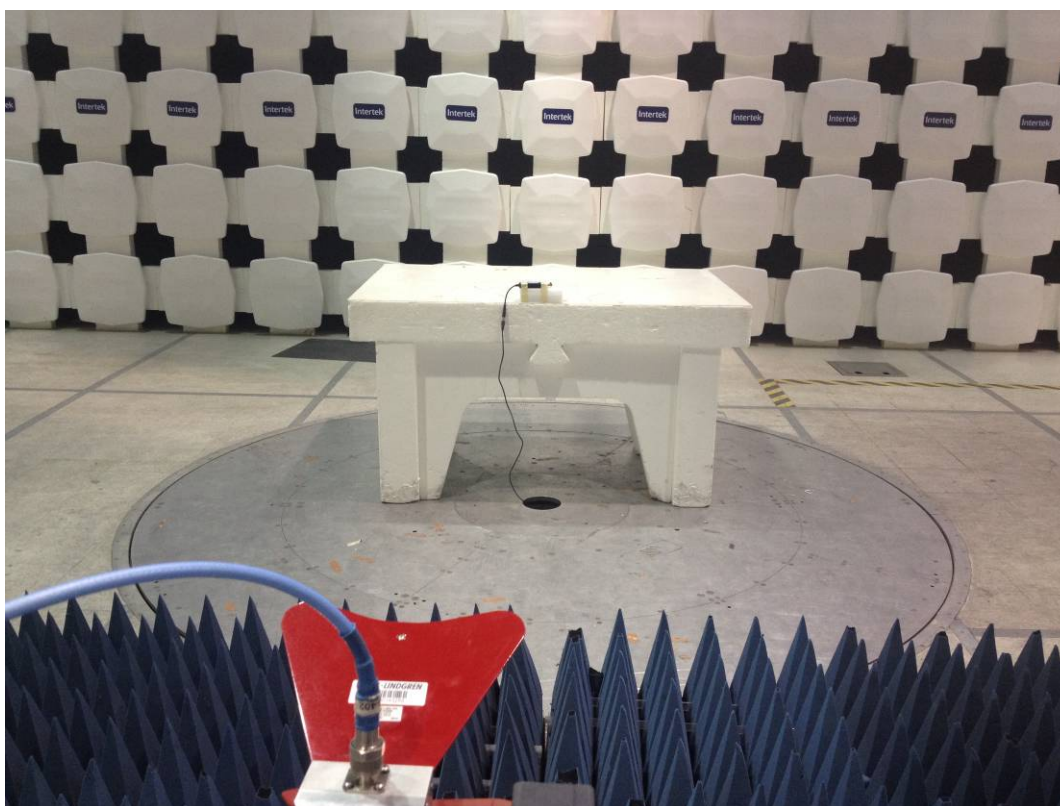
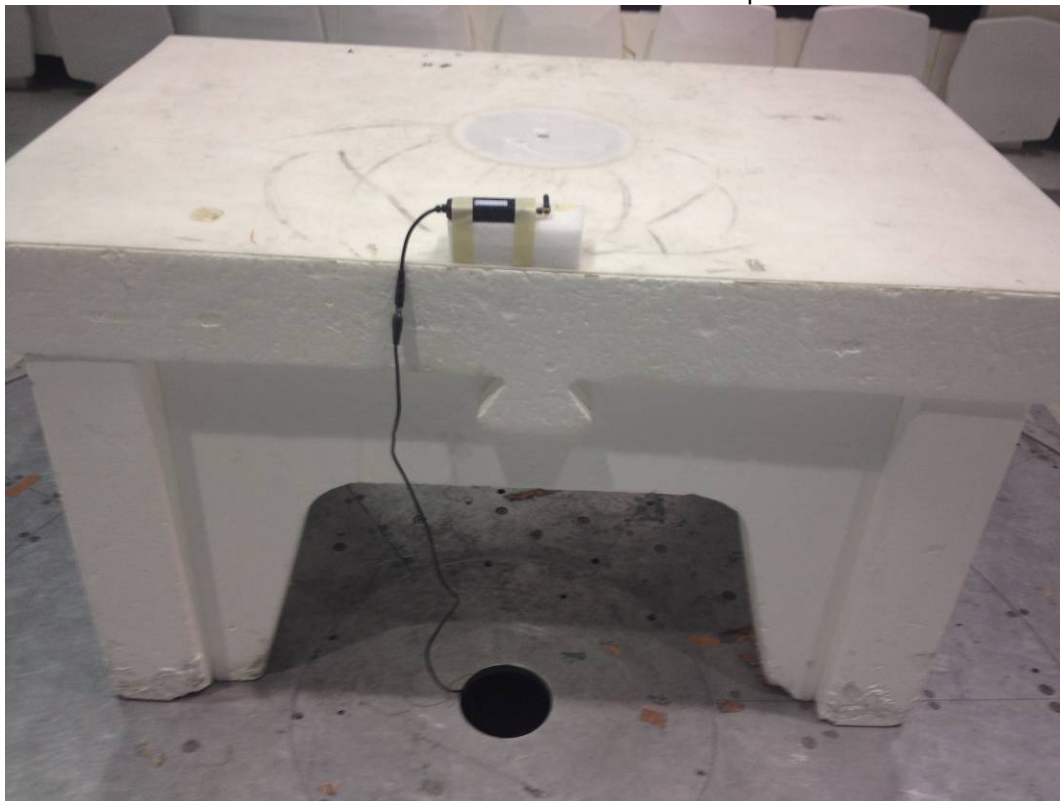
Y axis Radiated Emissions Test Setup



X axis Radiated Emissions Test Setup



Z axis Radiated Emissions Test Setup



9.5 Test Data:

2465 MHz Spectral Density Radiated Emissions

Company: QinetiQ North America, Technology
 Model #: PRD-1102196002
 Serial #: Prototype
 Engineers: Kouma Sinn
 Project #: G101602013
 Standard: FCC Part 15 Subpart C 15.247
 Receiver: 145-128
 PreAmp: PRE145014 12-18-2014.txt
 PreAmp Used? (Y or N): N
 Antenna & Cables: LF
 Antenna: ETS001 01-06-15.txt
 Cable(s): 145-416 3mTrkB 10-03-2014.txt
 Barometer: MAN1
 Bands: N, LF, HF, SHF
 ETS001 01-06-15.txt
 NONE.
 Location: 10m
 Date(s): 04/16/14
 Limit Distance (m): 3
 Test Distance (m): 3
 Voltage/Frequency: Laptop USB Powered
 Frequency Range: Fundamental
 Filter: NONE
 Attenuator: None
 Temp/Humidity/Pressure: 19c 34% 1014mbar
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net EIRP (dBm)	Limit EIRP (dBm)	Margin dB	Bandwidth
RF Output											
EIRP was obtained by applying the path loss correction a 3m distance, E(dBuV/m)-95.22 = dBm EIRP											
First Channel Set: Low 2465MHz, Mid 2469MHz & 2467MHz, High 2471MHz											
Low 2465 MHz. X-Axis (EUT sits on cable side) - No attenuator used											
PK	V	2465.000	59.07	32.26	6.03	0.00	0.00	2.15	8.00	-5.85	3/9kHz
PK	H	2465.000	62.07	32.26	6.03	0.00	0.00	5.15	8.00	-2.85	3/9kHz
Low 2465 MHz. Y-Axis (EUT sits on its long side) - No attenuator used											
PK	V	2465.000	59.62	32.26	6.03	0.00	0.00	2.70	8.00	-5.30	3/9kHz
PK	H	2465.000	58.62	32.26	6.03	0.00	0.00	1.70	8.00	-6.30	3/9kHz
Low 2465 MHz. Z-Axis flat on its back- No attenuator used											
PK	V	2465.000	56.19	32.26	6.03	0.00	0.00	-0.73	8.00	-8.73	3/9kHz
PK	H	2465.000	59.82	32.26	6.03	0.00	0.00	2.90	8.00	-5.10	3/9kHz

2471 MHz Power Spectral Density Radiated Emissions

Company: QinetiQ North America, Technology
 Model #: PRD-1102196002
 Serial #: Prototype
 Engineers: Kouma Sinn
 Project #: G101602013
 Standard: FCC Part 15 Subpart C 15.247
 Receiver: 145-128
 PreAmp: PRE145014 12-18-2014.txt
 PreAmp Used? (Y or N): N
 Antenna & Cables: LF
 Antenna: ETS001 01-06-15.txt
 Cable(s): 145-416 3mTrkB 10-03-2014.txt
 Barometer: MAN1
 Bands: N, LF, HF, SHF
 ETS001 01-06-15.txt
 NONE.
 Location: 10m
 Date(s): 04/16/14
 Limit Distance (m): 3
 Test Distance (m): 3
 Voltage/Frequency: Laptop USB Powered
 Frequency Range: Fundamental
 Filter: NONE
 Attenuator: None
 Temp/Humidity/Pressure: 19c 34% 1014mbar
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net EIRP (dBm)	Limit EIRP (dBm)	Margin dB	Bandwidth
RF Output											
EIRP was obtained by applying the path loss correction a 3m distance, E(dBuV/m)-95.22 = dBm EIRP											
First Channel Set: Low 2465MHz, Mid 2469MHz & 2467MHz, High 2471MHz											
Upper 2471 MHz. X-Axis (EUT sits on cable side) - No attenuator used											
PK	V	2471.000	57.15	32.28	6.04	0.00	0.00	0.25	8.00	-7.75	3/30kHz
PK	H	2471.000	61.41	32.28	6.04	0.00	0.00	4.51	8.00	-3.49	3/30kHz
Upper 2471 MHz. Y-Axis (EUT sits on its long side) - No attenuator used											
PK	V	2471.000	57.61	32.28	6.04	0.00	0.00	0.71	8.00	-7.29	3/30kHz
PK	H	2471.000	57.18	32.28	6.04	0.00	0.00	0.28	8.00	-7.72	3/30kHz
Upper 2471 MHz. Z-Axis flat on its back - No attenuator used											
PK	V	2471.000	58.35	32.28	6.04	0.00	0.00	1.45	8.00	-6.55	3/30kHz
PK	H	2471.000	61.85	32.28	6.04	0.00	0.00	4.95	8.00	-3.05	3/30kHz

2473 MHz Spectral Density Radiated Emissions

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/16/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 19C 32% 1016mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): N Voltage/Frequency: Laptop USB Powered Frequency Range: Fundamental
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net EIRP (dBm)	Limit EIRP (dBm)	Margin dB	Bandwidth	FCC
RF Output												
EIRP was obtained by applying the path loss correction a 3m distance, E(dBuV/m)-95.22 = dBm EIRP												
First Channel Set: Low 2473MHz, Mid 2475MHz & 2477MHz, High 2479MHz												
X-Axis (EUT sits on cable side) - No attenuator used												
PK	V	2473.000	56.14	32.28	6.05	0.00	0.00	-0.75	8.00	-8.75	3/30kHz	
PK	H	2473.000	60.20	32.28	6.05	0.00	0.00	3.31	8.00	-4.69	3/30kHz	
Y-Axis (EUT sits on its long side) - No attenuator used												
PK	V	2473.000	60.46	32.28	6.05	0.00	0.00	3.57	8.00	-4.43	3/30kHz	
PK	H	2473.000	56.74	32.28	6.05	0.00	0.00	-0.15	8.00	-8.15	3/30kHz	
Z-Axis(EUT sits flat)- No attenuator used												
PK	V	2473.000	51.63	32.28	6.05	0.00	0.00	-5.26	8.00	-13.26	3/30kHz	
PK	H	2473.000	62.13	32.28	6.05	0.00	0.00	5.24	8.00	-2.76	3/30kHz	

2479 MHz Power Density Radiated Emissions

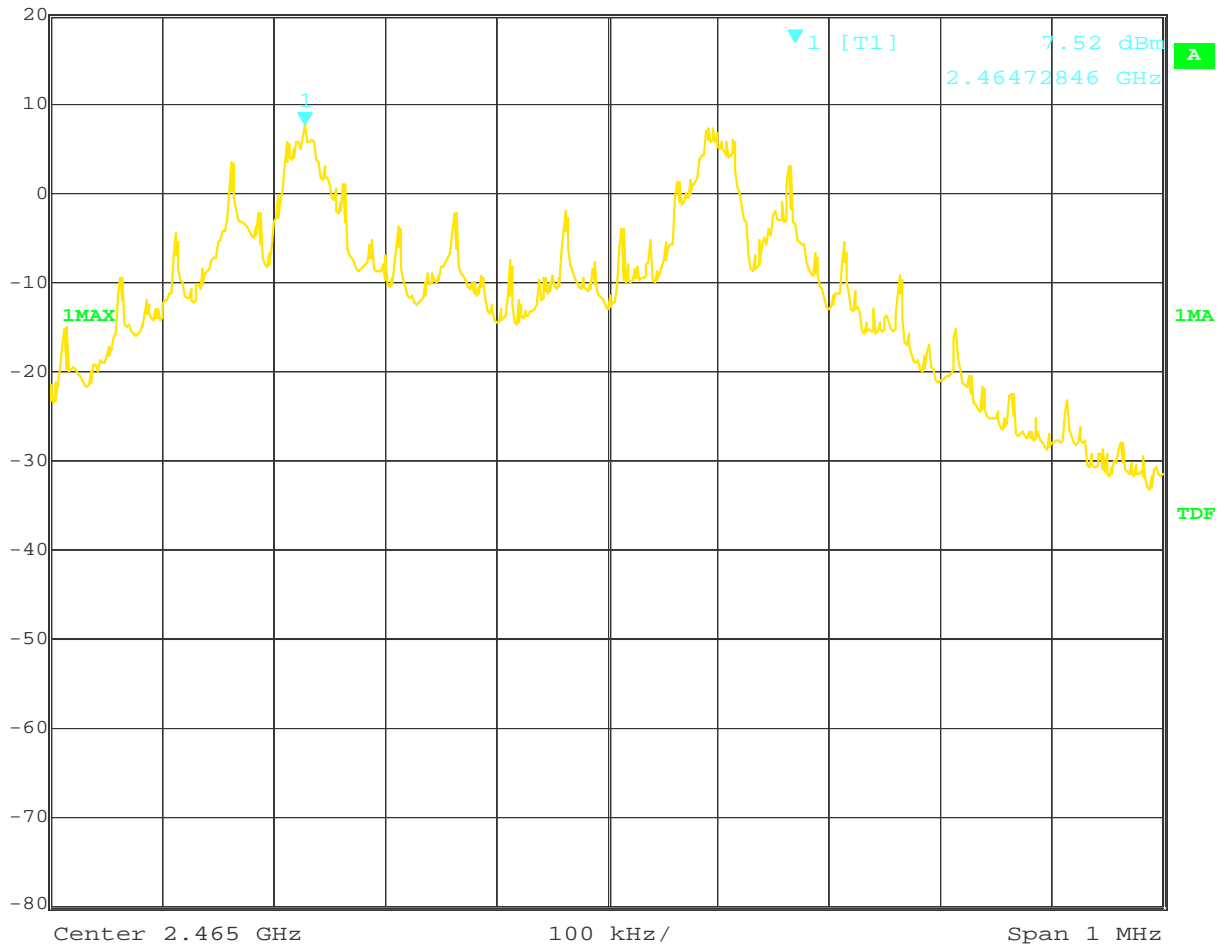
Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 04/17/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 21C 23% 1031mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): N Voltage/Frequency: Laptop USB Powered Frequency Range: Fundamental
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
EIRP was obtained by applying the path loss correction a 3m distance, E(dBuV/m)-95.22 = dBm EIRP											
First Channel Set: Low 2473MHz, Mid 2475MHz & 2477MHz, High 2479MHz											
X-Axis (EUT sits on cable side) - No attenuator used											
PK	V	2479.000	57.80	32.30	6.06	0.00	0.00	0.94	8.00	-7.06	3/9kHz
PK	H	2479.000	62.27	32.30	6.06	0.00	0.00	5.41	8.00	-2.59	3/9kHz
Y-Axis (EUT sits on its long side) - No attenuator used											
PK	V	2479.000	59.88	32.30	6.06	0.00	0.00	3.02	8.00	-4.98	3/9kHz
PK	H	2479.000	58.98	32.30	6.06	0.00	0.00	2.12	8.00	-5.88	3/9kHz
Z-Axis(EUT sits flat) - No attenuator used											
PK	V	2479.000	56.92	32.30	6.06	0.00	0.00	0.06	8.00	-7.94	3/9kHz
PK	H	2479.000	62.35	32.30	6.06	0.00	0.00	5.49	8.00	-2.51	3/9kHz

2465 MHz Antenna Port Conducted Spectral Density



Marker 1 [T1] RBW 3 kHz RF Att 30 dB
 Ref Lvl 7.52 dBm VBW 10 kHz
 20 dBm 2.46472846 GHz SWT 280 ms Unit dBm

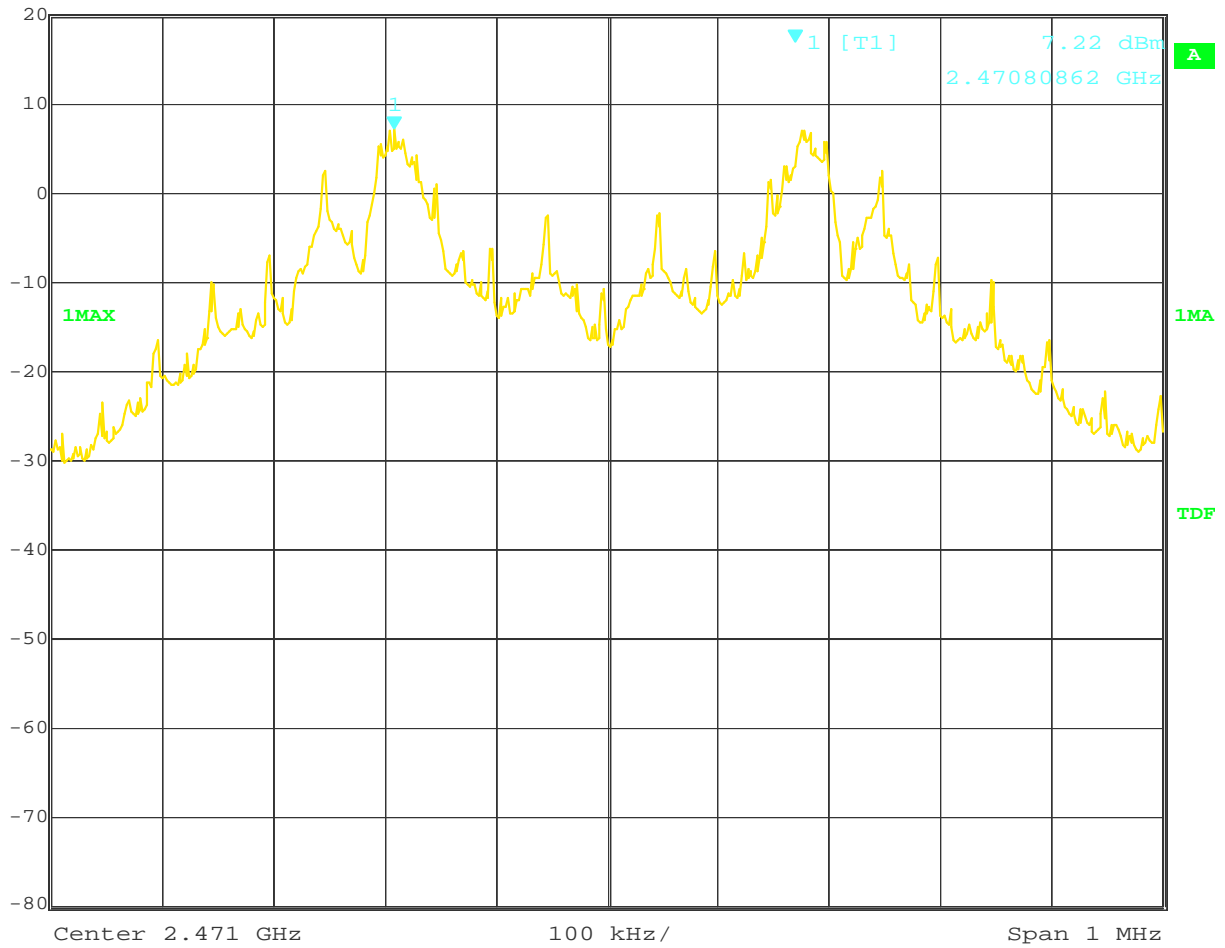


Date: 15.APR.2014 18:19:25

2471 MHz Antenna Port Conducted Spectral Density



Ref Lvl	Marker 1 [T1]	RBW	3 kHz	RF Att	30 dB
20 dBm	7.22 dBm	VBW	10 kHz		
	2.47080862 GHz	SWT	280 ms	Unit	dBm

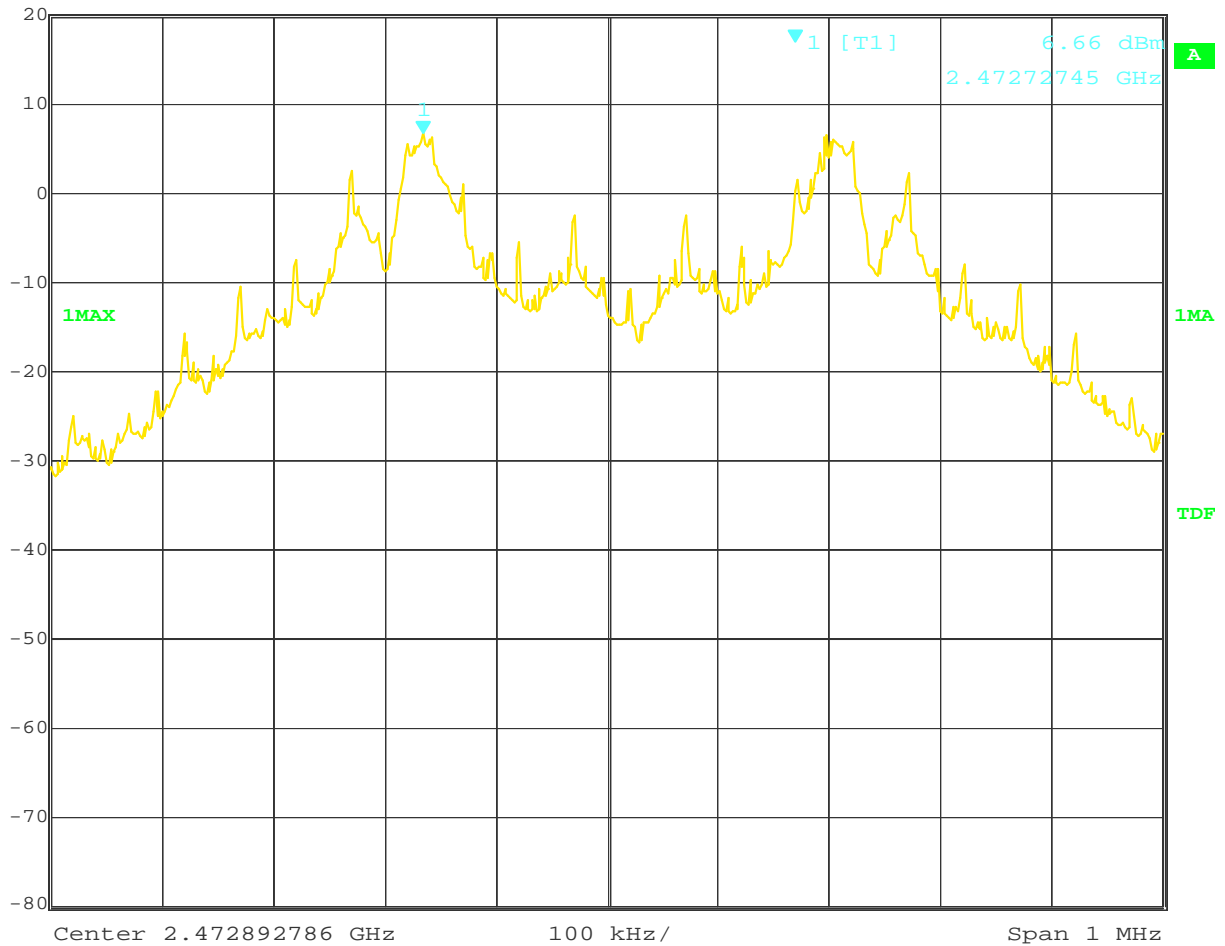


Date: 15.APR.2014 18:22:22

2473 MHz Antenna Port Conducted Spectral Density

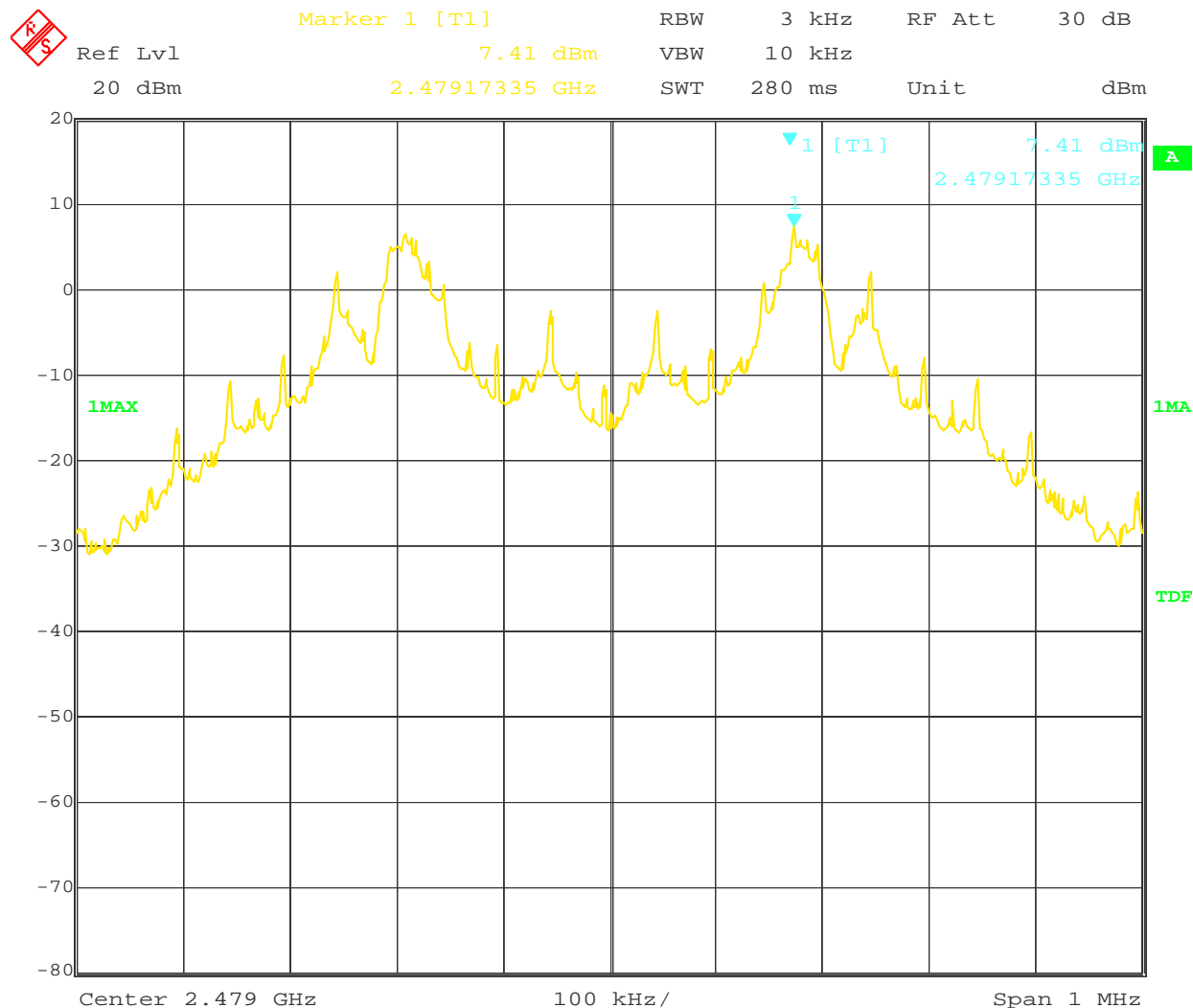


Marker 1 [T1] RBW 3 kHz RF Att 30 dB
 Ref Lvl 6.66 dBm VBW 10 kHz
 20 dBm 2.47272745 GHz SWT 280 ms Unit dBm



Date: 15.APR.2014 17:35:47

2479 MHz Antenna Port Conducted Spectral Density



Date: 15.APR.2014 17:57:06

Test Personnel: Kouma Sinn *KPS*
Supervising/Reviewing
Engineer:
(Where Applicable) N/A

Test Date: 04/15/2014, 04/16/2014

Product Standard: FCC Part 15.247,
RSS-210 Annex 8
Input Voltage: USB Powered
Pretest Verification w/
Ambient Signals or
BB Source: Ambient Signals

Limit Applied: Emissions below the limits
specified in Section 9.3
Ambient Temperature: 21, 19 °C
Relative Humidity: 56, 34 %
Atmospheric Pressure: 1000, 1014 mbars

Deviations, Additions, or Exclusions: None

10 Band-edge Compliance

10.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C Section 15.247, ANSI C63.4:2009, ANSI C63.10:2013, KDB558074 V03:2013, and RSS-210 Annex 8.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A wooden table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) $< U_{CISPR}$ (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dB μ V/m

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB μ V

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$
$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

10.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
WE118'	20 dB, Attenuator DC-18GHz	Weinschel Corp	47-20-34	BP0570	03/26/2014	03/26/2015
CBL030'	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 80	CBL030	04/05/2014	04/05/2015
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/17/2014	03/17/2015
ETS001'	1-18GHz DRG Horn Antenna	ETS-Lindgren	3117	00143259	01/06/2014	01/06/2015
145-416'	Cables 145-400 145-402 145-404 145-408	Huber + Suhner	3m Track B cables	multiple	10/04/2013	10/04/2014
MAN1'	Digital 4 Line Barometer	Mannix	OABA116	MAN1	08/13/2012	08/13/2014

Software Utilized:

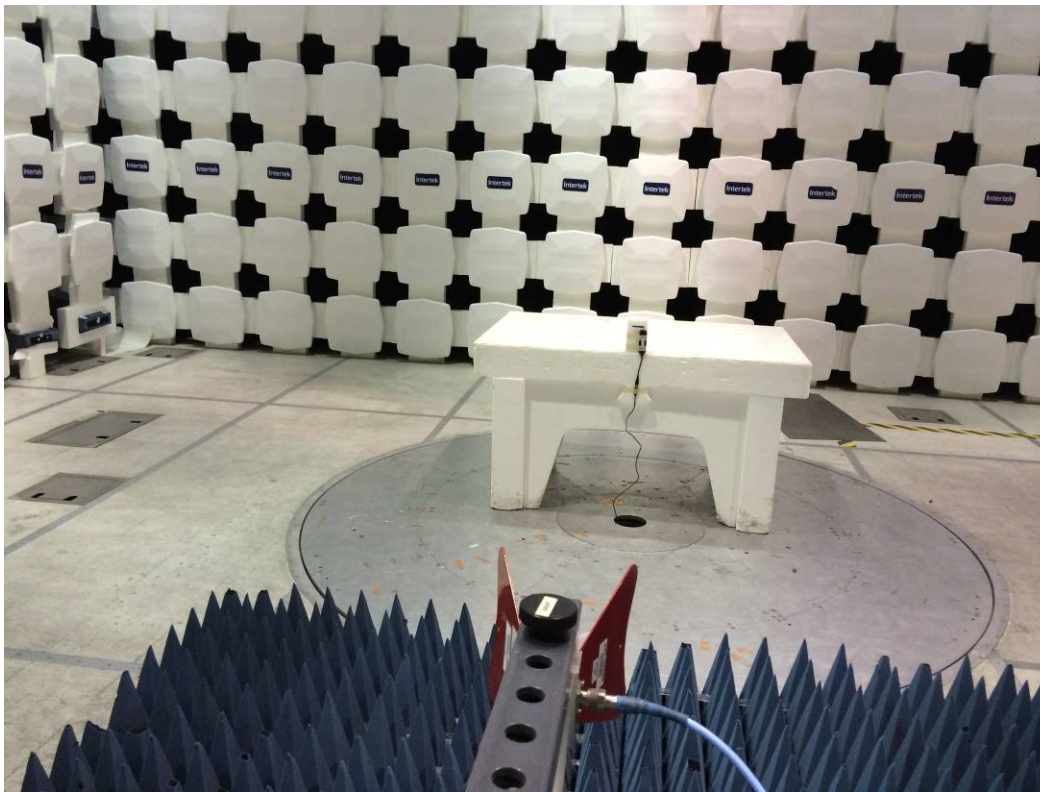
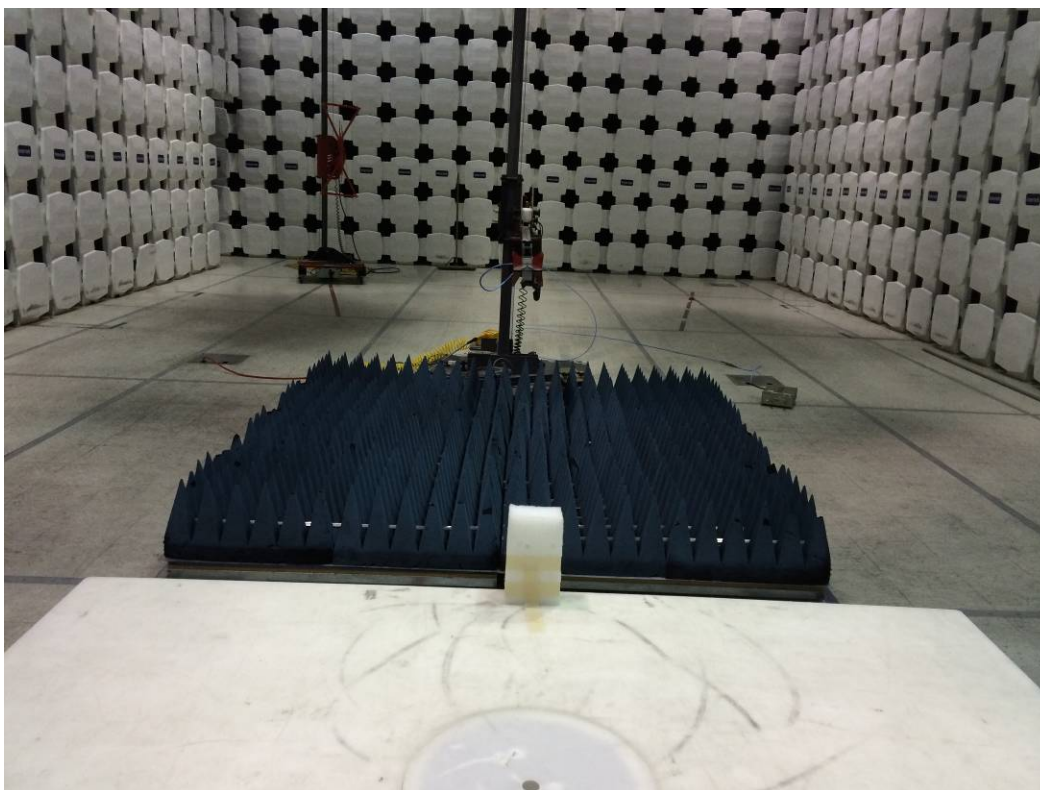
Name	Manufacturer	Version
Excel 2003	Microsoft	(11.8231.8221) SP3
EMI Boxborough.xls	Intertek	08/27/10

10.3 Results:

The sample tested was found to Comply.

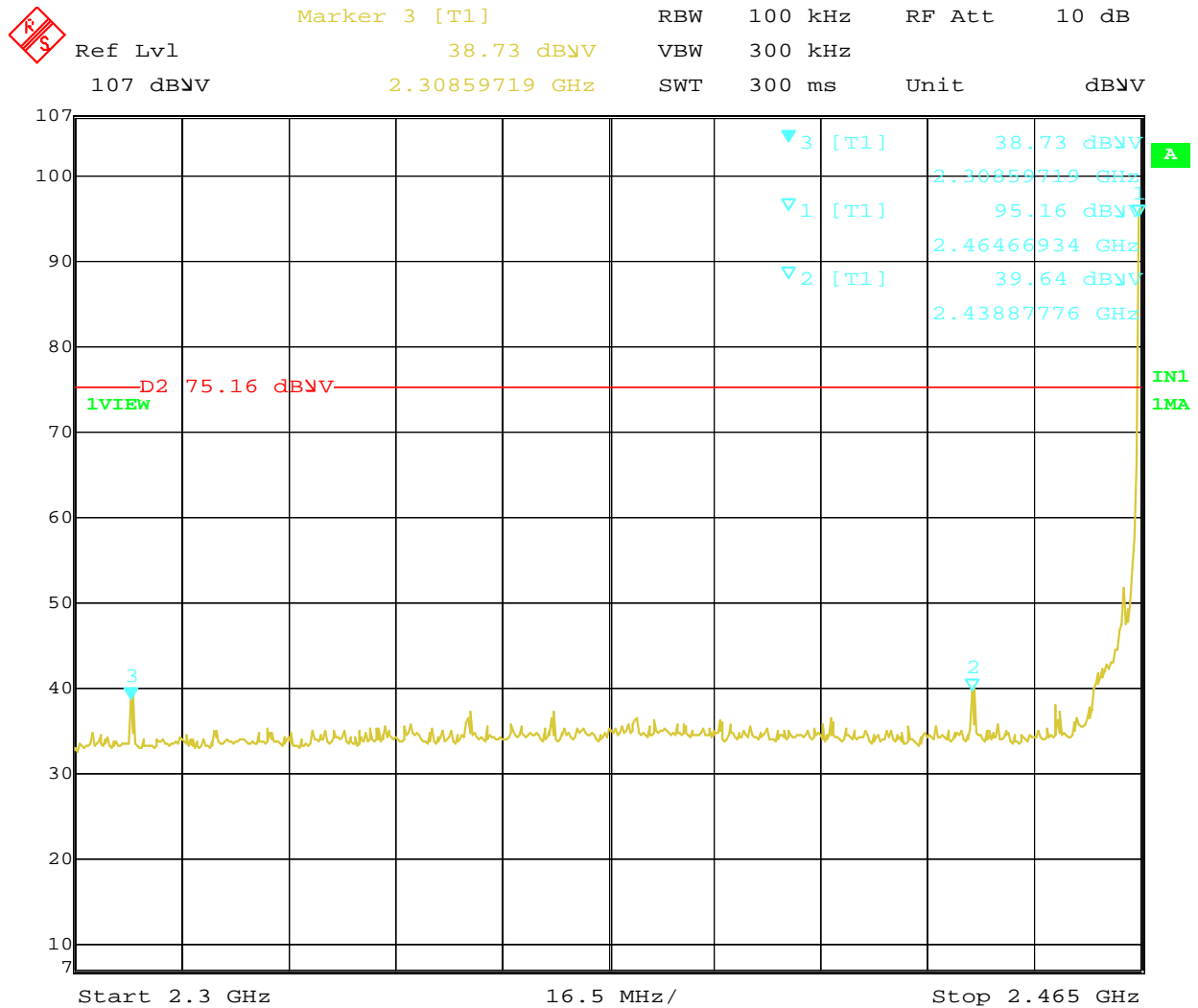
Spurious emissions at the band edges must be at least 20 dB lower than the fundamental field strength when measured with a 100 kHz bandwidth, without the need to be below the general limits of FCC Part 15 Section 15.209 and of RSS-Gen 7.2.5 Table 5. Emissions in restricted bands must meet the general limits of FCC Part 15 Section 15.209 and of RSS-Gen 7.2.5 Table 5.

10.4 Setup Photographs:



10.5 Test Data:

Lower Band Edge



Date: 17.MAY.2014 15:41:52

Upper Band Edge

Radiated Emissions

Company: QinetiQ North America, Technology Antenna & Cables: LF Bands: N, LF, HF, SHF
 Model #: PRD-1102196002 Antenna: ETS001 01-06-15.txt ETS001 01-06-15.txt
 Serial #: Prototype Cable(s): 145-416 3mTrkB 10-03-2014.txt NONE.
 Engineers: Kouma Sinn Location: 10m Barometer: MAN1 Filter: NONE
 Project #: G101602013 Date(s): 05/17/14
 Standard: FCC Part 15 Subpart C 15.247 Temp/Humidity/Pressure: 25C 32% 1004mbar
 Receiver: 145-128 Limit Distance (m): 3
 PreAmp: PRE145014 12-18-2014.txt Test Distance (m): 3
 PreAmp Used? (Y or N): N Voltage/Frequency: Laptop USB Powered Frequency Range: Upper Bandedge
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS: NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
PK, NF	H	2483.500	28.69	32.31	6.07	0.00	0.00	67.07	74.00	-6.93	1/3MHz	RB	
AVG, NF	H	2483.500	14.79	32.31	6.07	0.00	0.00	53.17	54.00	-0.83	1/3MHz	RB	
PK, NF	H	2500.000	27.67	32.35	6.10	0.00	0.00	66.12	74.00	-7.88	1/3MHz	RB	
AVG, NF	H	2500.000	13.77	32.35	6.10	0.00	0.00	52.22	54.00	-1.78	1/3MHz	RB	

For band-edge measurements in the restricted band that begins at 2483.5 MHz, a measurement bandwidth of 1 MHz is required. Therefore the "delta" technique may be used if the upper frequency edge of the occupied bandwidth of the fundamental emission is greater than or equal to 2481.5 MHz (2 MHz removed from the band edge). If the upper frequency edge of the occupied bandwidth is less than 2481.5 MHz, then radiated emissions within the restricted band shall be measured in the conventional manner. Since the measured occupied bandwidth is 2479.471 MHz, which is less than 2481.5 MHz, the measurement in the restricted band of 2483.5-2500 MHz were measured in a conventional manner. AVG = Peak-13.9dB (Average factor)

Test Personnel: Kouma Sinn *KPS*
Supervising/Reviewing Engineer:
(Where Applicable) N/A

Test Date: 05/17/2014

Product Standard: FCC Part 15.247,
RSS-210 Annex 8
Input Voltage: USB Powered
Pretest Verification w/
Ambient Signals or
BB Source: Ambient Signals

Limit Applied: Emissions below the limits
specified in Section 10.3

Ambient Temperature: 25 °C

Relative Humidity: 32%

Atmospheric Pressure: 1004 mbars

11 Digital Devices Radiated Spurious Emissions

11.1 Method

Tests are performed in accordance with FCC Part 15 Subpart B, IC ICES-003, and ANSI C63.4:2009.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A wooden table 80 cm high is used for table-top equipment.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.5 dB at 3m and 3.5 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) < U_{CISPR} (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dB μ V/m

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB μ V

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$
$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

11.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
MAN1'	Digital 4 Line Barometer	Mannix	0ABA116	MAN1	08/13/2012	08/13/2014
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/17/2014	03/17/2015
145-410'	Cables 145-400 145-403 145-405 145-406 145-407	Huber + Suhner	10m Track A Cables	multiple	10/04/2013	10/04/2014
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	10/01/2013	10/01/2014
145003'	Preamplifier (150 KHz to 1.3 GHz)	Hewlett Packard	8447D	2443A04077	10/07/2013	10/07/2014

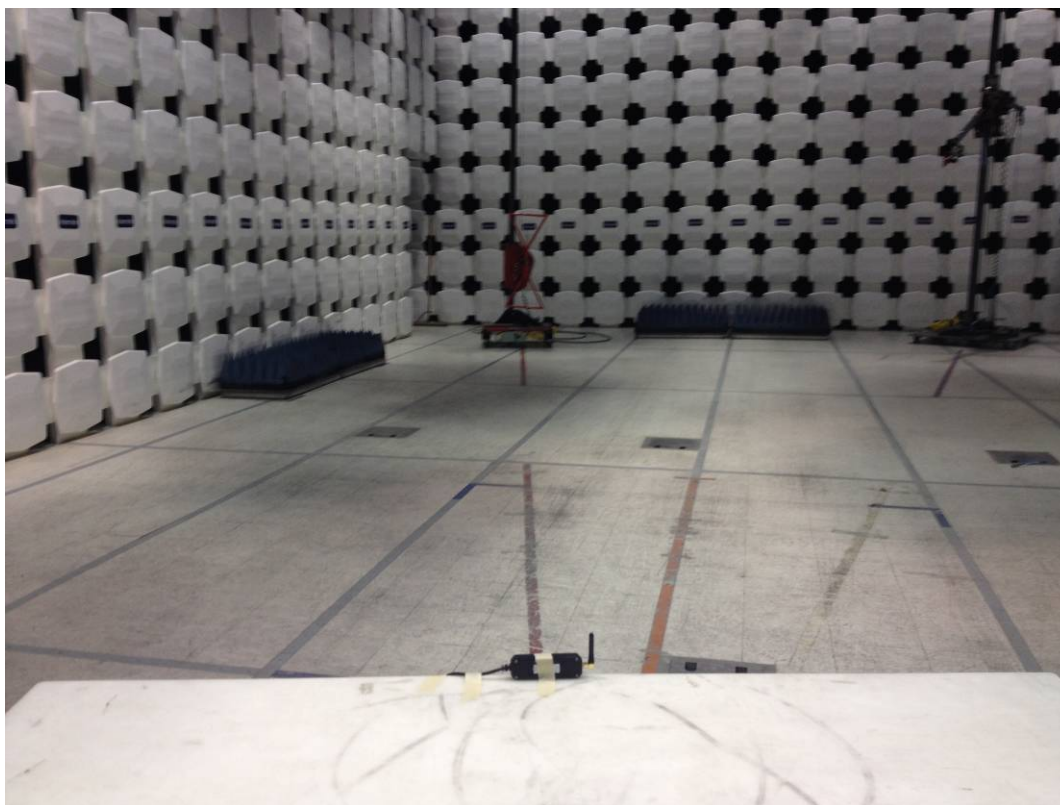
Software Utilized:

Name	Manufacturer	Version
C5 Emissions	TESEQ	5.26.46.46
EMI Boxborough.xls	Intertek	08/27/2010

11.3 Results:

The sample tested was found to comply.

11.4 Setup Photographs:



11.5 Plots/Data:

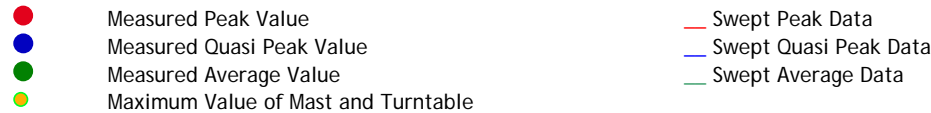
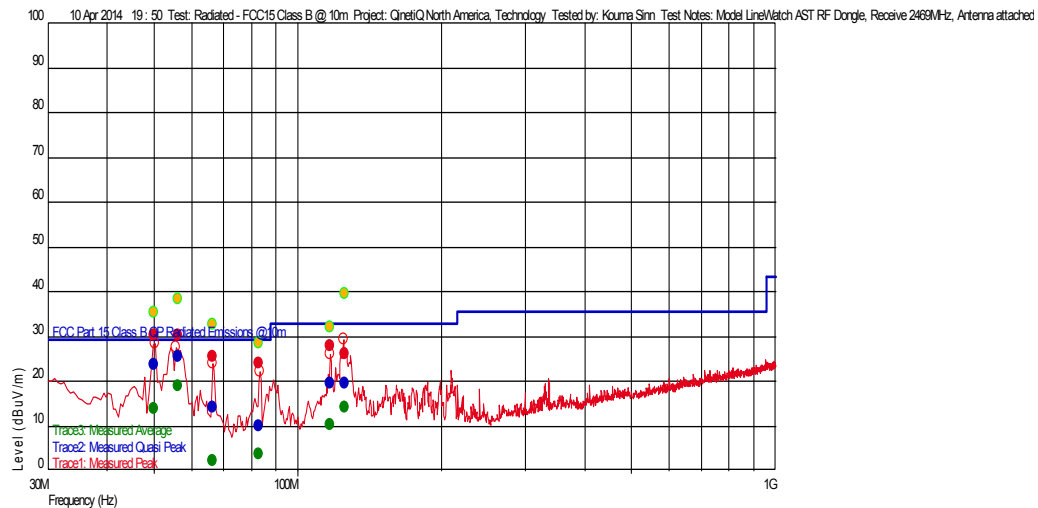
Receive Mode at 2469 MHz, Antenna attached

Test Information

Test Details User Entry
Test: Radiated - FCC15 Class B @ 10m
Project: QinetiQ North America, Technology
Test Notes: Model PRD-1102196002, Receive 2469MHz, Antenna attached
Temperature: 22C
Humidity: 23%, 1007mbar
Tested by: Kouma Sinn
Test Started: 10 Apr 2014 19 : 50

Additional Information

Prescan Emission Graph



Emissions Test Data

Trace1: Measured Peak

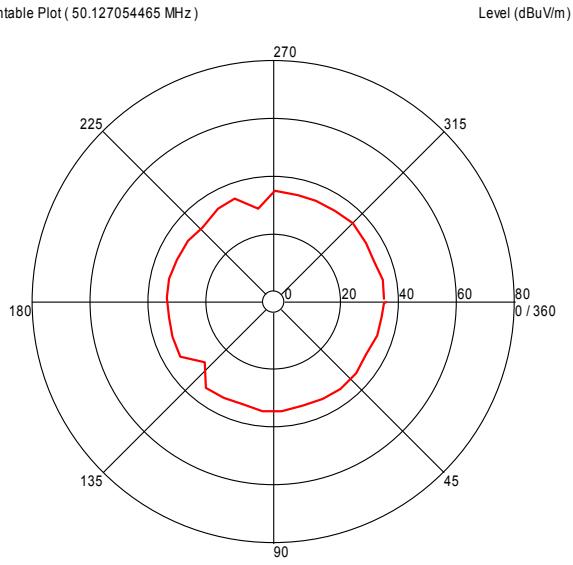
Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (-), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
125.425851645 M	26.15	14.385	-25.363	--	--		267	1.45	120 k	
83.133066305 M	24.13	7.387	-25.690	--	--		138	1.91	120 k	
117.057114273 M	27.97	13.711	-25.402	--	--		174	3.23	120 k	
66.622645499 M	25.47	7.962	-25.920	--	--		136	1.05	120 k	
50.127054465 M	30.29	7.862	-25.873	--	--		1	1.04	120 k	
56.198196367 M	30.31	7.120	-26.009	--	--		0	1.04	120 k	

Trace2: Measured Quasi Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (-), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
83.133066305 M	10.05	7.387	-25.690	29.540	-19.49		138	1.91	120 k	
66.622645499 M	14.08	7.962	-25.920	29.540	-15.46		136	1.05	120 k	
117.057114273 M	19.55	13.711	-25.402	33.040	-13.49		174	3.23	120 k	
125.425851645 M	19.65	14.385	-25.363	33.040	-13.39		267	1.45	120 k	
50.127054465 M	23.63	7.862	-25.873	29.540	-5.91		1	1.04	120 k	
56.198196367 M	25.51	7.120	-26.009	29.540	-4.03		0	1.04	120 k	

Azimuth Plots

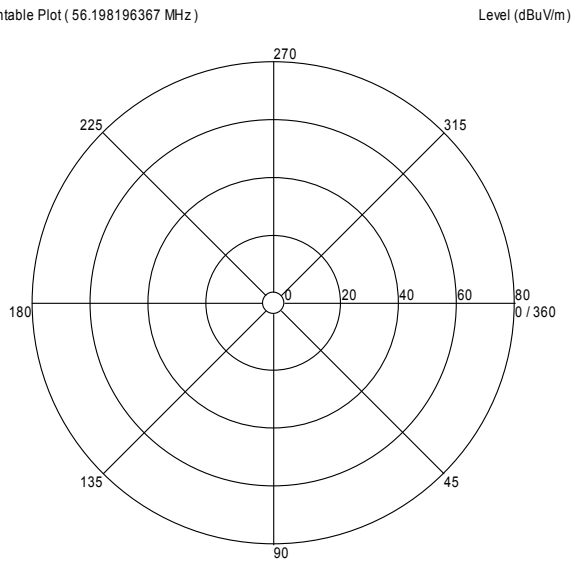
Turntable Plot (50.127054465 MHz)



All Polarities

Azimuth (Degrees)

Turntable Plot (56.198196367 MHz)

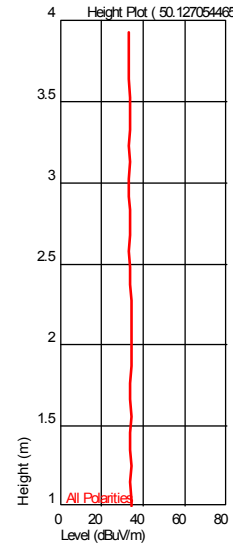


All Polarities

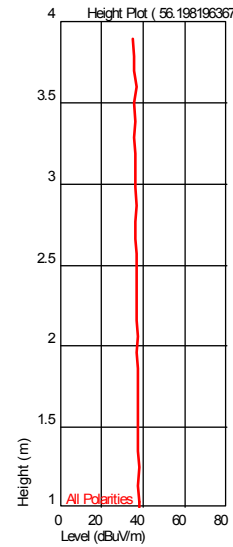
Azimuth (Degrees)

Turntable Plots

Height Plot (50.127054465 MHz)

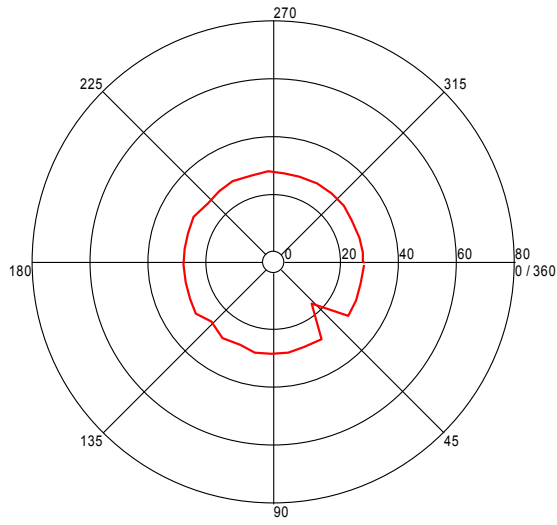


Height Plot (56.198196367 MHz)



Turntable Plot (66.622645499 MHz)

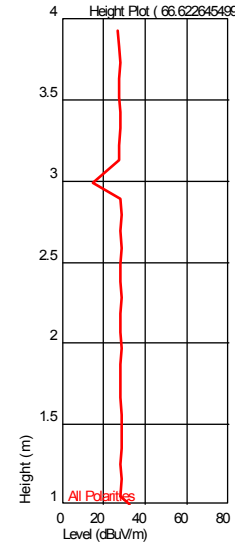
Level (dBuV/m)



All Polarities

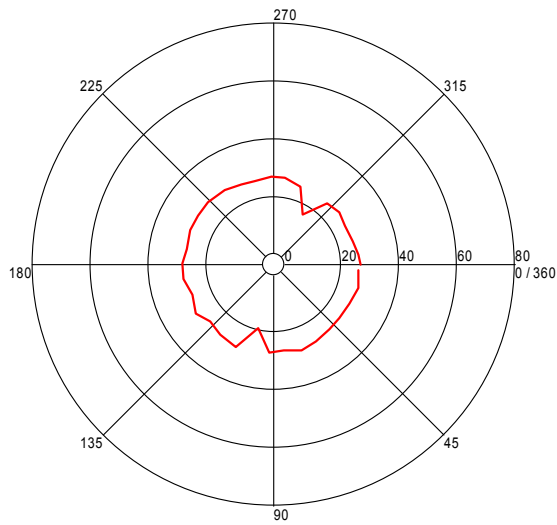
Azimuth (Degrees)

Height Plot (66.622645499 MHz)



Turntable Plot (83.133066305 MHz)

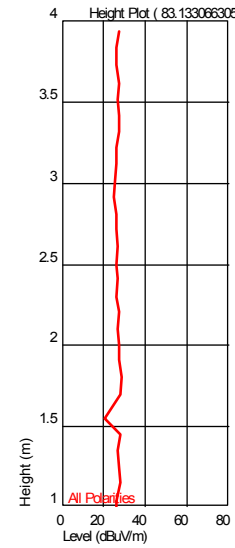
Level (dBuV/m)



All Polarities

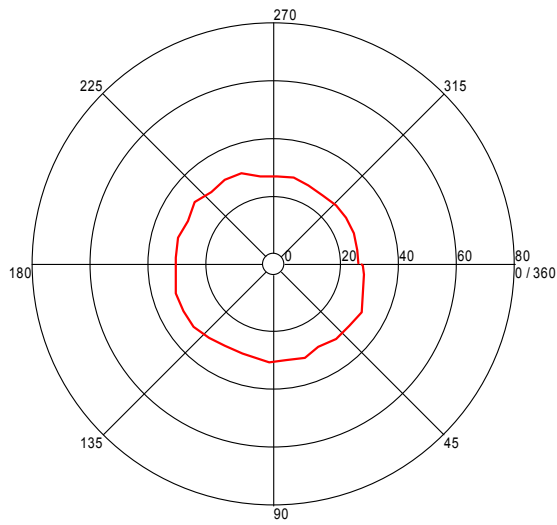
Azimuth (Degrees)

Height Plot (83.133066305 MHz)



Turntable Plot (117.057114273 MHz)

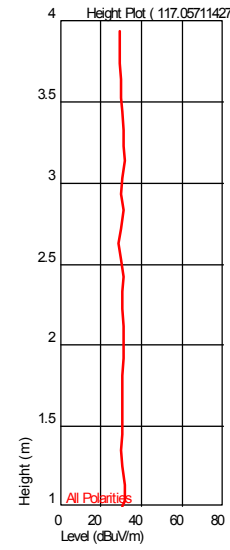
Level (dBuV/m)



All Polarities

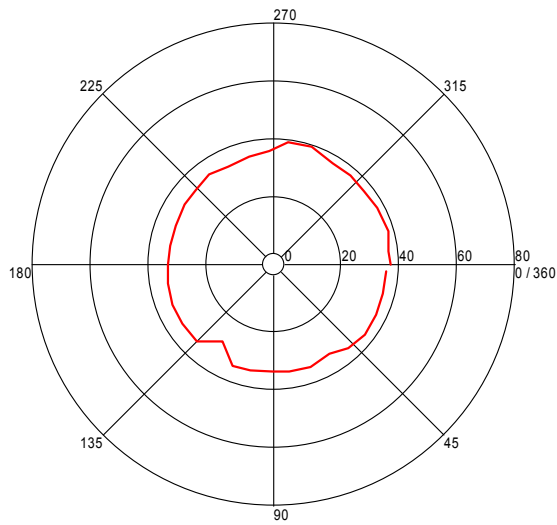
Azimuth (Degrees)

Height Plot (117.057114273 MHz)



Turntable Plot (125.425851645 MHz)

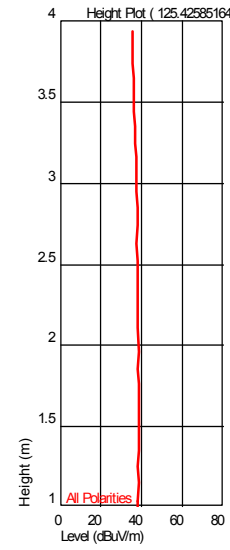
Level (dBuV/m)



All Polarities

Azimuth (Degrees)

Height Plot (125.425851645 MHz)



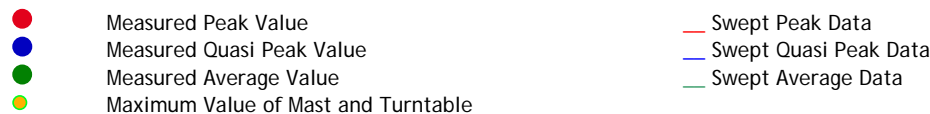
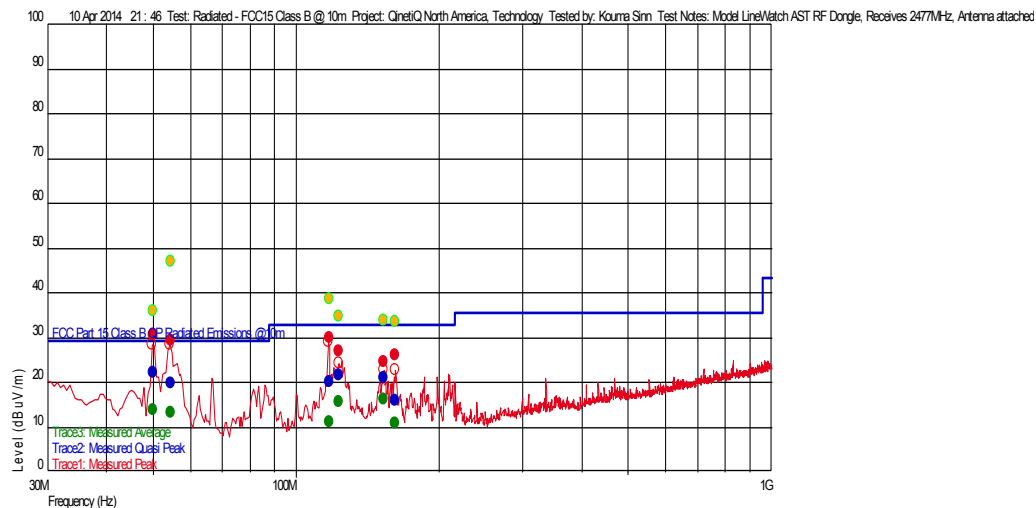
Receive Mode at 2477 MHz, Antenna attached

Test Information

Test Details User Entry
Test: Radiated - FCC15 Class B @ 10m
Project: QinetiQ North America, Technology
Test Notes: Model PRD-1102196002, Receives 2477MHz, Antenna attached
Temperature: 22C
Humidity: 23%, 1007mbar
Tested by: Kouma Sinn
Test Started: 10 Apr 2014 21 : 46

Additional Information

Prescan Emission Graph



Emissions Test Data

Trace1: Measured Peak

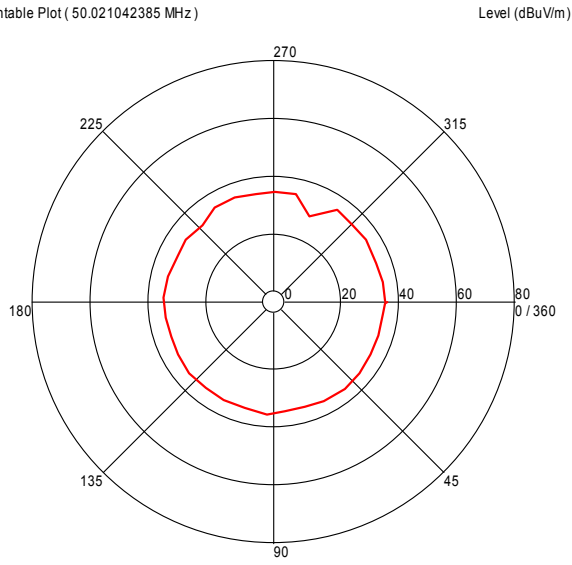
Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (-), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
152.958116429 M	24.66	12.604	-25.170	--	--		8	1.26	120 k	
162.010421104 M	26.01	12.299	-24.923	--	--		247	1.24	120 k	
123.225651076 M	27.07	14.223	-25.373	--	--		50	1.87	120 k	
117.405010064 M	30.02	13.781	-25.400	--	--		224	2.99	120 k	
54.691382571 M	29.28	7.069	-25.976	--	--		1	3.62	120 k	
50.021042385 M	30.52	7.894	-25.870	--	--		1	1.26	120 k	

Trace2: Measured Quasi Peak

Frequency(Hz)	Level (dBuV/m)	AF	PA+CL	Limit(dBuV/m)	Margin(dBuV/m)	Hor (-), Ver ()	Azimuth (deg)(Deg)	Mast Height(m)	RBW(Hz)	Comment
162.010421104 M	16.11	12.299	-24.923	33.040	-16.93		247	1.24	120 k	
117.405010064 M	20.13	13.781	-25.400	33.040	-12.91		224	2.99	120 k	
152.958116429 M	21.09	12.604	-25.170	33.040	-11.95		8	1.26	120 k	
123.225651076 M	21.72	14.223	-25.373	33.040	-11.32		50	1.87	120 k	
54.691382571 M	19.88	7.069	-25.976	29.540	-9.66		1	3.62	120 k	
50.021042385 M	22.24	7.894	-25.870	29.540	-7.30		1	1.26	120 k	

Azimuth Plots

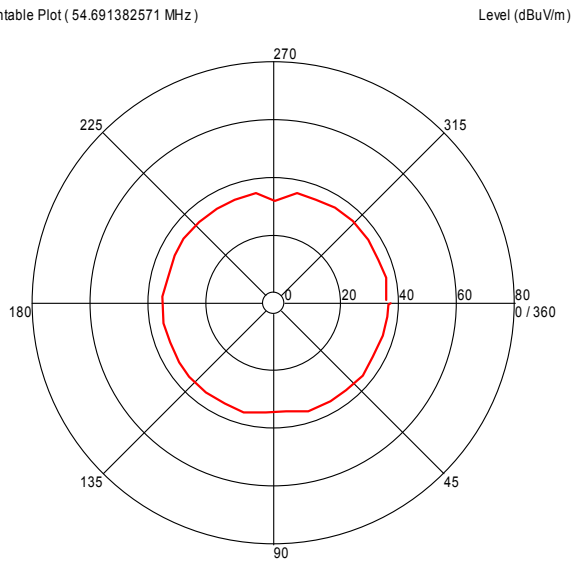
Turntable Plot (50.021042385 MHz)



All Polarities

Azimuth (Degrees)

Turntable Plot (54.691382571 MHz)

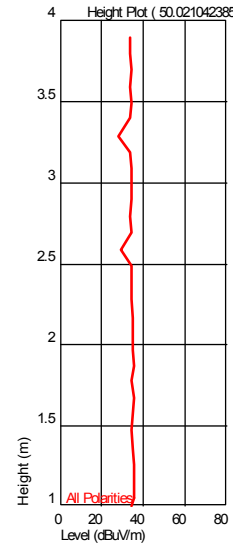


All Polarities

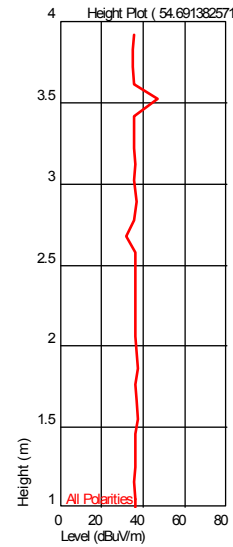
Azimuth (Degrees)

Turntable Plots

Height Plot (50.021042385 MHz)

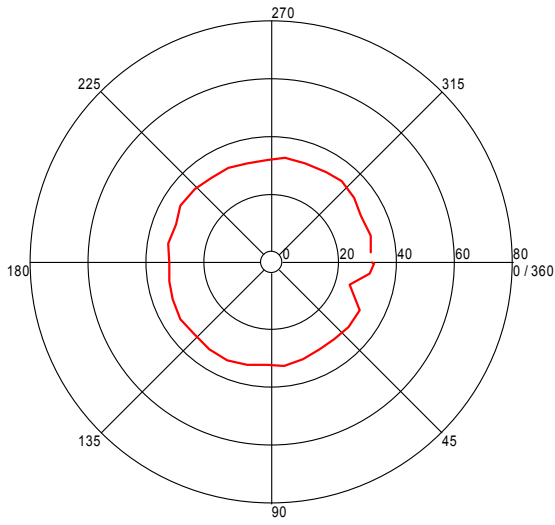


Height Plot (54.691382571 MHz)



Turntable Plot (117.405010064 MHz)

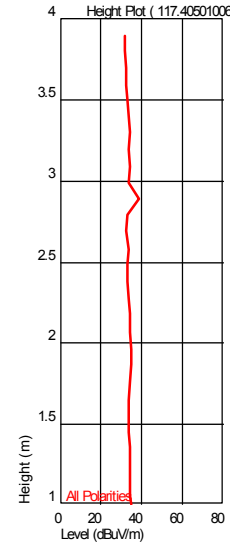
Level (dBuV/m)



All Polarities

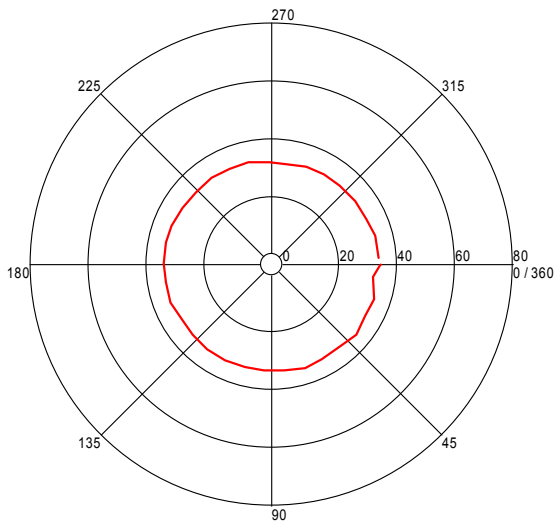
Azimuth (Degrees)

Height Plot (117.405010064 MHz)



Turntable Plot (123.225651076 MHz)

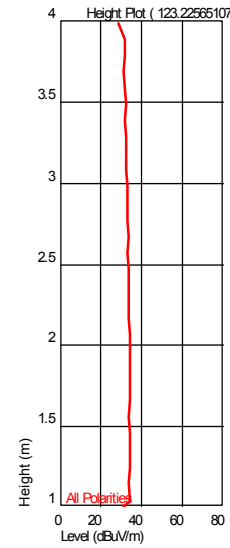
Level (dBuV/m)



All Polarities

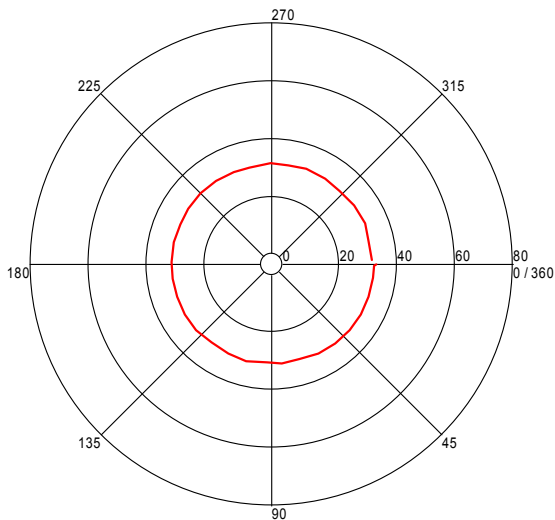
Azimuth (Degrees)

Height Plot (123.225651076 MHz)



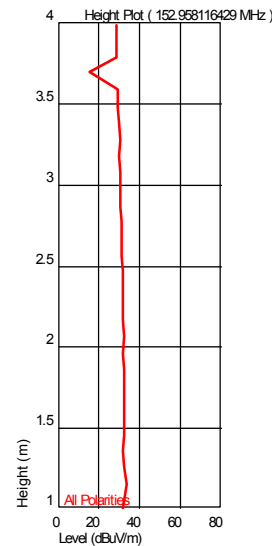
Turntable Plot (152.958116429 MHz)

Level (dBuV/m)



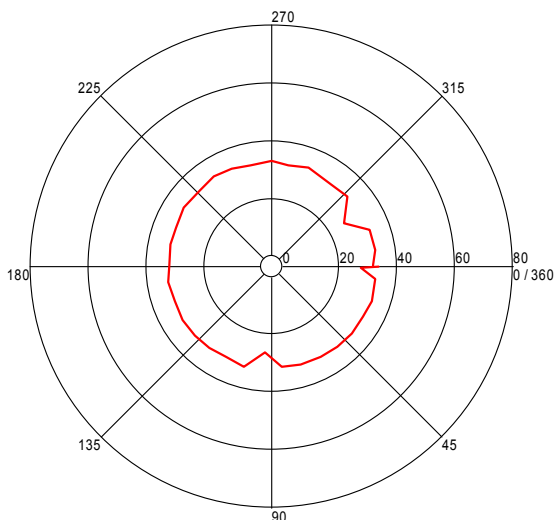
All Polarities

Azimuth (Degrees)



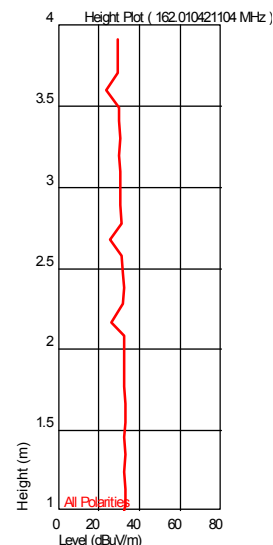
Turntable Plot (162.010421104 MHz)

Level (dBuV/m)



All Polarities

Azimuth (Degrees)



Test Personnel: Kouma Sinn *KPS*
 Supervising/Reviewing Engineer: N/A
 (Where Applicable)
 Product Standard: FCC Part 15.247, RSS-210 Annex 8
 Input Voltage: USB Powered
 Pretest Verification w/ Ambient Signals or BB Source: BB Source

Test Date: 04/10/2014

Limit Applied: Emissions below the limits specified in Section 11.3

Ambient Temperature: 22 °C

Relative Humidity: 23 %

Atmospheric Pressure: 1007 mbars

Deviations, Additions, or Exclusions: None

12 AC Mains Conducted Emissions

12.1 Method

Tests are performed in accordance with FCC Part 15 Subpart B, IC ICES-003, and ANSI C63.4:2009.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Measurement Uncertainty

For conducted emissions, U_{lab} (3.1 dB in worst case) $< U_{CISPR}$ (3.6 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculations

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where NF = Net Reading in dB μ V

RF = Reading from receiver in dB μ V

LF = LISN or ISN Correction Factor in dB

CF = Cable Correction Factor in dB

AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB μ V

Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 285.1 \mu\text{V/m}$$

12.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
ROS002'	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	06/18/2013	06/18/2014
CBLBNC2012-7'	50 Ohm Coaxial Cable	Pomona	RG58C/U	CBLBNC2012-7	11/13/2013	11/13/2014
DS26A'	Attenuator, 20dB	Mini Circuits	20dB, 50 ohm	DS26A	10/04/2013	10/04/2014
LISN31'	CISPR 16 LISN	Com-Power	LI-215A	191957	02/26/2014	02/26/2015
LISN30'	CISPR 16 LISN	Com-Power	LI-215A	191961	02/26/2014	02/26/2015
DAV004'	Weather Station	Davis Instruments	7400	PE80529A61A	09/25/2012	09/25/2014

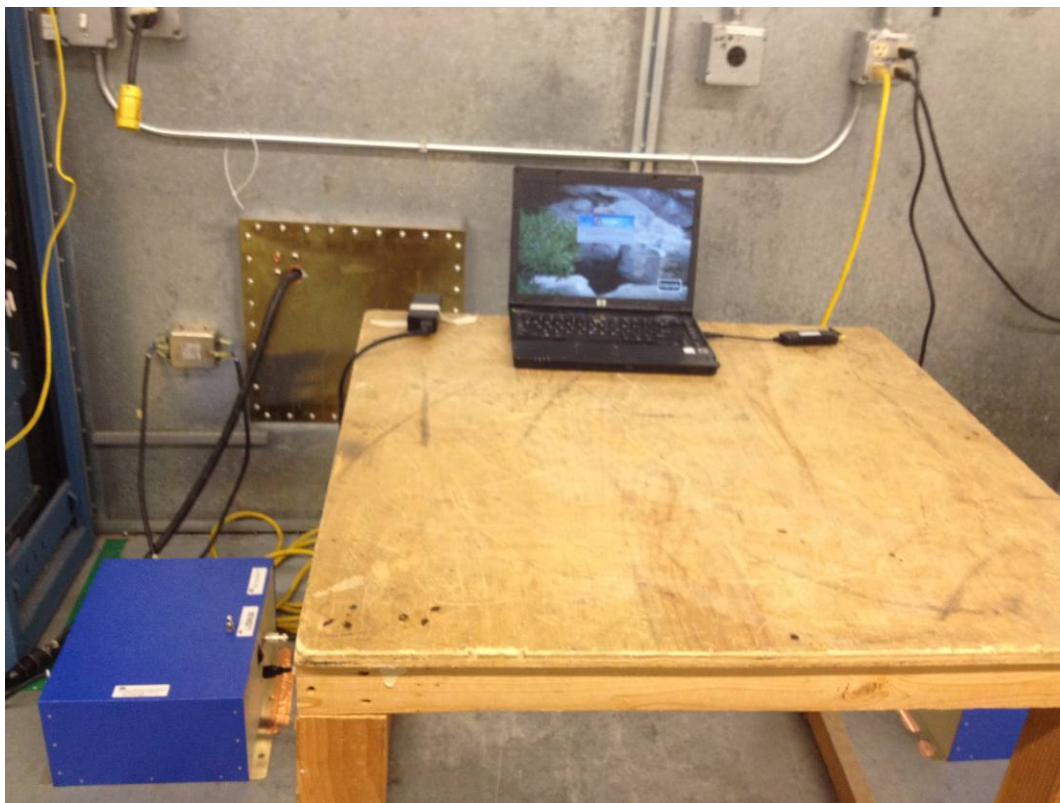
Software Utilized:

Name	Manufacturer	Version
C5 Emissions	TESEQ	5.26.46.46

12.3 Results:

The sample tested was found to Comply.

12.4 Setup Photographs:



12.5 Plots/Data:

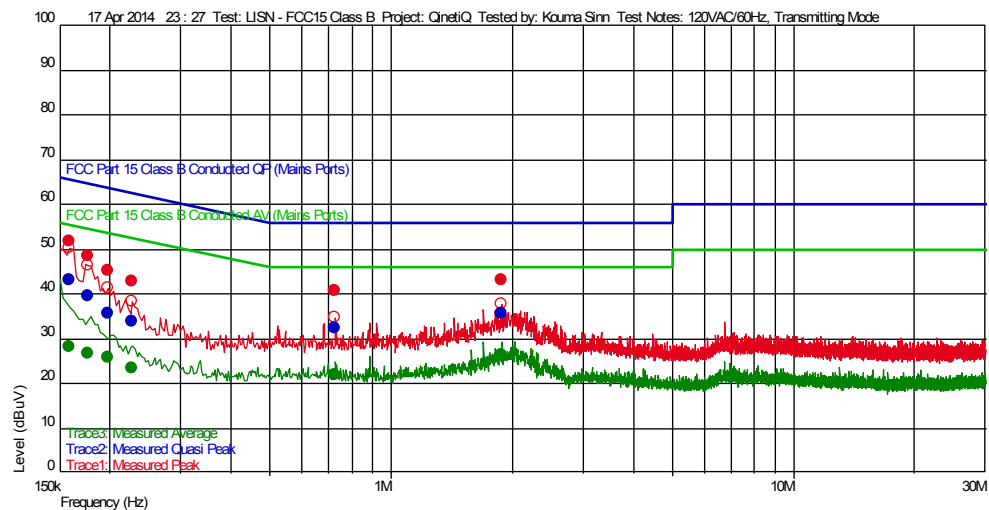
Transmit Mode at 2479 MHz, 120VAC/60Hz

Test Information

Test Details
Test: User Entry
Project: LISN - FCC15 Class B
Test Notes: QinetiQ
Temperature: 120VAC/60Hz, Transmitting Mode, 2479 MHz
Humidity: 23C
Tested by: 24%, 1030mbar
Test Started: Kouma Sinn
17 Apr 2014 23 : 27

Additional Information

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable

- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace2: Measured Quasi Peak

Frequency(Hz)	Level(dBuV)	TF	PA+CL	Limit(dBuV)	Margin(dBuV)	RBW(Hz)	Comment	LINE
228.0 k	33.79	0.050	20.735	62.522	-28.74	9 k		N
198.0 k	35.58	0.050	20.733	63.694	-28.11	9 k		L1
177.0 k	39.58	0.055	20.732	64.625	-25.04	9 k		N
726.0 k	32.41	0.023	20.741	56.000	-23.59	9 k		N
159.0 k	43.04	0.058	20.731	65.516	-22.48	9 k		N
1.89 M	35.80	0.030	20.670	56.000	-20.20	9 k		N

Trace3: Measured Average

Frequency(Hz)	Level(dBuV)	TF	PA+CL	Limit(dBuV)	Margin(dBuV)	RBW(Hz)	Comment	LINE
228.0 k	23.47	0.050	20.735	52.522	-29.05	9 k		N
177.0 k	26.82	0.055	20.732	54.625	-27.80	9 k		N
198.0 k	25.90	0.050	20.733	53.694	-27.80	9 k		L1
159.0 k	28.18	0.058	20.731	55.516	-27.33	9 k		N
726.0 k	21.81	0.023	20.741	46.000	-24.19	9 k		N
1.89 M	26.52	0.030	20.670	46.000	-19.48	9 k		N

Receive Mode at 2469 MHz, 120VAC/60Hz

Test Information

Test Details

Test:

Project:

Test Notes:

Temperature:

Humidity:

Tested by:

Test Started:

User Entry

LISN - FCC15 Class B

QinetiQ

120VAC/60Hz, Receive Mode, 2469 MHz

23C

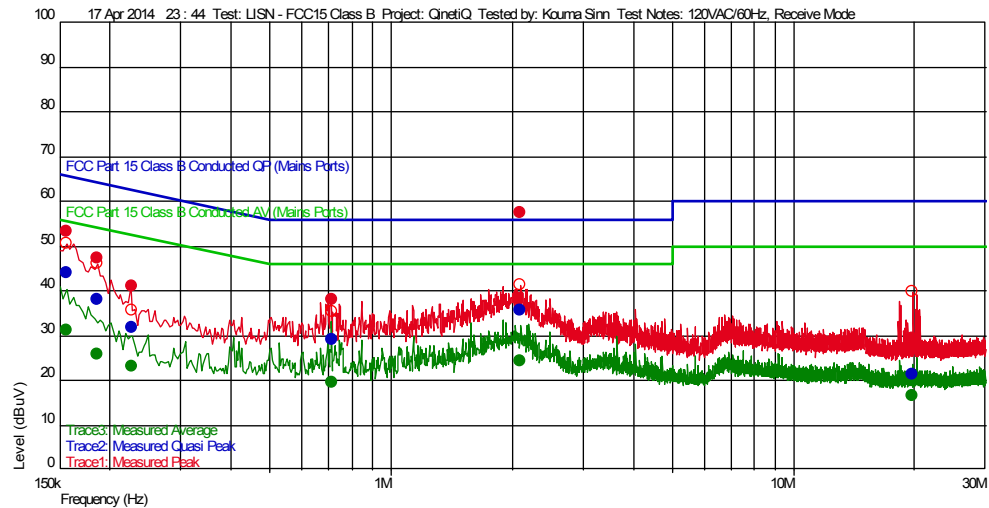
24%, 1030mbar

Kouma Sinn

17 Apr 2014 23 : 44

Additional Information

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable

- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace2: Measured Quasi Peak

Frequency(Hz)	Level(dBuV)	TF	PA+CL	Limit(dBuV)	Margin(dBuV)	RBW(Hz)	Comment	LINE
19.821 M	21.29	0.070	20.766	60.000	-38.71	9 k		N
228.0 k	31.77	0.050	20.735	62.522	-30.75	9 k		L1
717.0 k	29.06	0.021	20.741	56.000	-26.94	9 k		N
186.0 k	37.93	0.053	20.732	64.213	-26.28	9 k		N
156.0 k	43.99	0.059	20.730	65.674	-21.68	9 k		L1
2.1 M	35.56	0.030	20.657	56.000	-20.44	9 k		N

Trace3: Measured Average

Frequency(Hz)	Level(dBuV)	TF	PA+CL	Limit(dBuV)	Margin(dBuV)	RBW(Hz)	Comment	LINE
19.821 M	16.52	0.070	20.766	50.000	-33.48	9 k		N
228.0 k	23.10	0.050	20.735	52.522	-29.42	9 k		L1
186.0 k	25.76	0.053	20.732	54.213	-28.45	9 k		N
717.0 k	19.44	0.021	20.741	46.000	-26.56	9 k		N
156.0 k	31.09	0.059	20.730	55.674	-24.58	9 k		L1
2.1 M	24.38	0.030	20.657	46.000	-21.62	9 k		N

Test Personnel: Kouma Sinn *KPS*
Supervising/Reviewing
Engineer:
(Where Applicable) N/A
Product Standard: FCC Part 15.247,
RSS-210 Annex 8
Input Voltage: USB Powered via Laptop
Pretest Verification w/
Ambient Signals or
BB Source: Ambient Signals

Test Date: 04/17/2014

Limit Applied: Class B
Ambient Temperature: 23 °C
Relative Humidity: 24 %
Atmospheric Pressure: 1030 mbars

Deviations, Additions, or Exclusions: None

13 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	05/20/2014	101602013BOX-001a	KPS <i>KPS</i>	VFV <i>VFV</i>	Original Issue
1	05/29/2014	101602013BOX-001b	KPS <i>KPS</i>	VFV <i>VFV</i>	Revised average power calculation using 20.24% duty cycle on page 21