

EMC TEST REPORT	
<b>TEST REPORT NUMBER</b>	OFP 1522ITE105-A
<b>TEST REPORT DATE</b>	10-May-2016
<b>TEST REPORT VERSION</b>	1.01
<b>MANUFACTURER</b>	NEOCORTEC A/S
<b>PRODUCT NAME</b>	NEOCORTEC Wireless Module
<b>PRODUCT MODEL</b>	NC2400C1
<b>CONDITION OF EUT WHEN RECEIVED</b>	Good and in working condition
<b>ISSUED TO</b>	NEOCORTEC A/S C/o HP Ventures A/S, Nannasgade 28, 2. sal 2200 Copenhagen N, Denmark.
<b>ISSUED BY</b>	<b>TARANG Lab</b> Wipro Technologies, SJP2, Survey#70,77,78/8A, Dodda Kanelli, Sarjapur road, Bangalore. Karnataka. India - 560 035 Tel: +91-80-30292929 Fax: +91-80-30298200 Email: tarang.planet@wipro.com Web: <a href="http://www.wipro.com">www.wipro.com</a>

## AMENDMENT HISTORY

Amendment Number	Amendment Date	Author of Amendment	Previous Report Version	Previous Report Date
1.01	09 <sup>th</sup> May 2016	Dikshit Ravi Teja V	1.0	30 March 2016
<b>Amendment Details</b>	<ul style="list-style-type: none"> <li>• Cable loss details added under section 4.1.</li> </ul>			

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## 1 TEST REPORT SUMMARY

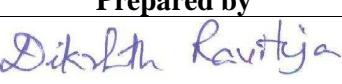
<b>Applicant</b>	NEOCORTEC A/S
<b>Manufacturer</b>	NEOCORTEC A/S
<b>Product Name</b>	NEOCORTEC Wireless Module
<b>Product Model</b>	NC2400C1
<b>Product Serial Number</b>	NA
<b>Date of Test</b>	26 <sup>th</sup> May 2015 to 26 <sup>th</sup> Jun 2015
<b>Venue of Test</b>	Tarang Lab

<b>Applicable Standard</b>	<b>FCC Section</b>	<b>RSS Rule part</b>	<b>Description</b>	<b>Results</b>
47 CFR Ch. I (10-1-13 Ed), Part 15, Subpart C; RSS-Gen, Issue 4, Nov 2014 RSS 247 Issue 1 May 2015	§15.207	RSS-Gen 8.8	Conducted emissions test	PASS
	§15.209	RSS-Gen 8.9, RSS-Gen 8.10	Radiated emissions test	PASS
	§15.205	RSS-Gen, 8.10	Emissions in restricted frequency bands	PASS
	§15.247 (a) (2)	RSS 247.5.2 (1)	6 dB Bandwidth measurement	PASS
	§15.247 (b) (3)	RSS 247.5.4 (4)	Maximum conducted output power	PASS
	§15.247 (e)	RSS 247.5.2 (1)	Power spectral density	PASS
	§15.247 (d)	RSS 247.5.5	Radio frequency power in any 100 kHz bandwidth outside the Intentional band	PASS
	§15.247 (d)	RSS 247.5.5	Operating band edge measurements	PASS

**Neocortec NC2400C1 Wireless Module** was tested by Tarang Lab as per the standards that are listed in the table above. Based on the observations during the test and interpretations by Tarang lab, results have been indicated. The test results produced in this report shall apply only to the above sample that has been tested under the specific conditions and modes of testing as described in the report. Other similar equipment may not necessarily reproduce same result due to production tolerances and measurement uncertainties. Any measurement uncertainties listed in this report are for information purpose only.

The results shall stand invalid, in case there are any modifications / additions / removals to the hardware or software or end use atmosphere to the product tested. This report shall not be modified or in any way revised unless it is expressly permitted and endorsed by Tarang lab, through a duly authorized representative. Particulars on Manufacturer / Supplier / Product configuration / performance criteria, given in this report, are based on the information given by the customer, along with test request. Tarang does not assume any responsibility for the correctness of such information for the above mentioned equipment under test.

Customer acknowledges that this is a test report and not a certificate to gain market access for the product. To gain market access, Customer needs appropriate clearance from the Government or authorized agency for the target market. For markets that allow self-declaration, customer needs to follow the procedure defined by the target market.

<b>Prepared by</b>	<b>Reviewed by</b>	<b>Approved by</b>
		
Dikshit Ravi Teja V EMI /EMC Test Engineer	Narendra Babu M Lead EMI/EMC Test Engineer	Satheesh I Technical Manager

## 2 GENERAL INFORMATION

### 2.1 ACCREDITATION DETAILS

Following are the accreditation and listing details for Tarang.

Accreditation / Listing body	Registration / Company / Certificate Number
NABL, India	Certificate No: T-1533, T-1534 <a href="http://www.nabl-india.org/">http://www.nabl-india.org/</a>
FCC (Federal Communications Commission)	Registration Number: 799247 <a href="http://www.fcc.gov/">http://www.fcc.gov/</a>
IC (Industry Canada)	Company Number: 9023A-1 <a href="http://www.ic.gc.ca">http://www.ic.gc.ca</a>

### 2.2 MEASUREMENT UNCERTAINTY

The following measurement uncertainties are applicable to the relevant tests that are mentioned below:

Name of the test	Measurement Uncertainty
Radiated Emission from 9 kHz to 30 MHz at 3 meter	$\pm 1.9055$ dB
Radiated Emission from 30 MHz to 1 GHz at 10 meter	$\pm 4.6388$ dB
Radiated Emission from 1 GHz to 18 GHz at 3 meter	$\pm 3.2271$ dB
Radiated Emission from 18 GHz to 26.5 GHz at 3 meter	$\pm 3.7810$ dB
Conducted Emission from 150 kHz to 30 MHz	$\pm 1.6322$ dB

### 3 INSTRUMENTATION AND CALIBRATION

#### 3.1 TEST AND MEASURING EQUIPMENT

The list of following measuring equipment used for this testing conforms to the applicable standards. Performance of all test and measuring equipment including any accessories are checked periodically to ensure accuracy.

#### 3.2 EQUIPMENTS USED

Name of Equipment	Manufacturer	Model No.	Serial No.	Calibration Due
EMI Test Receiver	R&S	ESU8	100324	10 <sup>th</sup> Mar 2016
EMI Test Receiver	R&S	ESIB40	100306	04 <sup>th</sup> Jul 2015
Hybrid Log Periodic Antenna	TDK	HLP-3003C	130334	25 <sup>th</sup> Jul 2015
Pre-Amplifier	SONOMA	310	270817	14 <sup>th</sup> Apr 2016
V-LISN	SME	NSLK 8128	8128-243	08 <sup>th</sup> Aug 2015
Pulse Limiter	R&S	ESH3-Z2	101260	26 <sup>th</sup> Mar 2016
Double Ridged BB Horn	SME	BBHA 9120D	9120D 688	05 <sup>th</sup> Aug 2015
Broadband Horn Antenna	SME	BBHA 9170	9170 336	11 <sup>th</sup> Nov 2015
Preamplifier	TDK RF solutions	PA 02	100008	14 <sup>th</sup> Apr 2016
Preamplifier	TDK RF solutions	Preamp	2007331	10 <sup>th</sup> Nov 2015
Preamplifier	TDK RF solutions	Preamp	2007332	10 <sup>th</sup> Nov 2015
Active Loop Antenna	ETS Lindgren	6507	00104711	22 <sup>nd</sup> Apr 2015
Spectrum Analyzer	Agilent Technologies	E4407B	MY45112948	02 <sup>nd</sup> Apr 2016

## 4 PRODUCT INFORMATION

### 4.1 DESCRIPTION OF THE PRODUCT

The NEOCORTEC Wireless Module is a mobile Ad-Hoc network module operates in the range from 2400 MHz to 2483.5 MHz. This compliant transceiver enabling ultra-low power bi-directional wireless multi hop mesh network communication. It can support the network size up to 65,000 nodes. No dedicated nodes required for network control. All nodes are fully capable and autonomous. It is used in Wireless sensor networks, automatic meter reading, mobile Ad-hoc network, home control & building automation, industrial automation & monitoring purposes etc.

The EUT is configured in below defined channels

LOW CHANNEL	2401.312012 MHz
MID CHANNEL	2441.749954 MHz
HIGH CHANNEL	2482.187897 MHz

<b>Product</b>	NEOCORTEC Wireless Module
<b>Model Number</b>	NC2400C1
<b>Serial Number</b>	NA
<b>Product Category / Type of Equipment</b>	ITE
<b>EUT Operating Voltage</b>	3.6 V DC
<b>EUT Operating Current (Max)</b>	27.5 mA

Table 1: EUT details

S. No.	Cable/Port Name	Cable Color	Cable Length (mm)	Cable Loss (dB)	Power / Interconnection cable	Shielded / Unshielded
1	RF Cable (SMA Bulk Head)	Black	200	0.65	Interconnection (RF Cable)	Shielded

Table 2: List of cables used for the testing

### 4.2 SOFTWARE AND FIRMWARE DETAILS

Smart RF Studio 7 from Texas instrument

## 5 TEST DETAILS

### 5.1 PRODUCT AND TEST SETUP

#### 5.1.1 PRODUCT CONFIGURATION

The EUT was powered through DC power supply (3.6VDC). The EUT was programmed to continuous transmit mode and the output was monitored in Spectrum Analyzer. Figure 1 shows the product configuration during the tests. The operating frequency range of EUT is from 2400 MHz to 2483.5 MHz. During Radiated Emission test, the laptop was removed once the configuration was done. During all other tests, laptop was kept near to the EUT and connection was established.

#### 5.1.2 TEST SETUP DETAILS

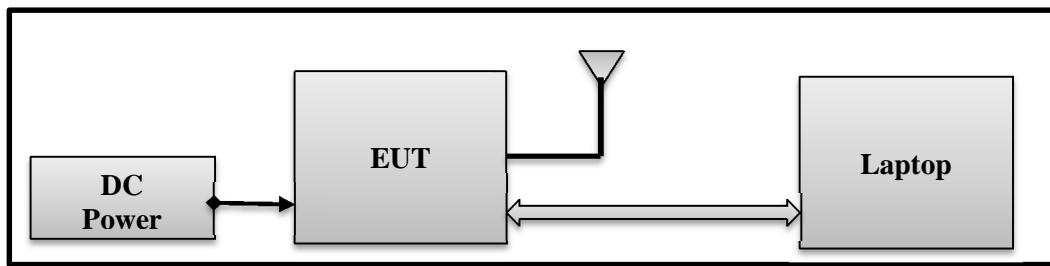


Figure 1: EUT Configuration

#### 5.1.3 ACCESSORIES

Item	Manufacturer	Model Number	Serial Number
Laptop	Wipro	WNBER7PEM4712R	FE-200100212
Titanis 2.4 GHz Swivel Antenna (2.2dBi)	Antennova	B4844 / B6090	NA

## 5.2 APPLICABLE TESTS

Applicable Standard	Description	Test level / Test Voltage	Applicability
47 CFR Ch. I (10–13 Ed), Part 15, Subpart C;  RSS-Gen, Issue 4, Nov 2014  RSS 247 Issue 1 May 2015	Conducted Emission test	150 kHz to 30 MHz	Power lines
	Radiated Emissions test	9 kHz to 26.5 GHz	Enclosure
	Emissions in Restricted frequency bands	9 kHz to 26.5 GHz	Enclosure
	6 dB Bandwidth measurement	$\geq 500$ kHz	Antenna port
	Maximum Conducted Output Power	$\leq 1$ Watt	Antenna port
	Power Spectral Density	Power spectral density should be $\leq 8$ dBm in 3 kHz bandwidth	Antenna port
	Conducted Spurious Emissions	20 dB below intentional frequency	Antenna port
	Operating Band edge measurements	2400 MHz to 2483.5 MHz	Antenna port

## 5.3 TEST RESULT

### 5.3.1 CONDUCTED EMISSION

#### 5.3.1.1 TEST SPECIFICATION

<b>Test Standard</b>	47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C RSS-Gen, Issue 4, Nov 2014
<b>Test Procedure</b>	ANSI C63.4-2014
<b>Type of Cable (Shielded/Unshielded)</b>	Shielded
<b>Frequency Range</b>	150 kHz to 30MHz
<b>Resolution Bandwidth</b>	9 kHz
<b>Video Bandwidth</b>	30 kHz
<b>Step size</b>	4 kHz
<b>Pre Scan Measurement Time</b>	20 ms
<b>Final Measurement Time</b>	1 second
<b>Attenuation</b>	10 dB
<b>Detector</b>	Peak, Quasi peak and Average
<b>Input Voltage</b>	3.6 V DC
<b>Input Frequency</b>	NA
<b>Temperature</b>	23.0 °C
<b>Humidity</b>	58.0 %
<b>Tested By</b>	Suresh.G.N.
<b>Test Date</b>	01 <sup>st</sup> Jun 2015

#### 5.3.1.2 LIMITS

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Quasi Peak Limit (dB<math>\mu</math>V/m)</b>	<b>Average Limit (dB<math>\mu</math>V/m)</b>
47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C	§15.207	150 kHz to 500 kHz 500 kHz to 5 MHz 5 MHz to 30 MHz	66 to 56* 56 60	56 to 46* 46 50
RSS-Gen, Issue 4, Nov 2014	8.8			

### 5.3.1.3 TEST SETUP

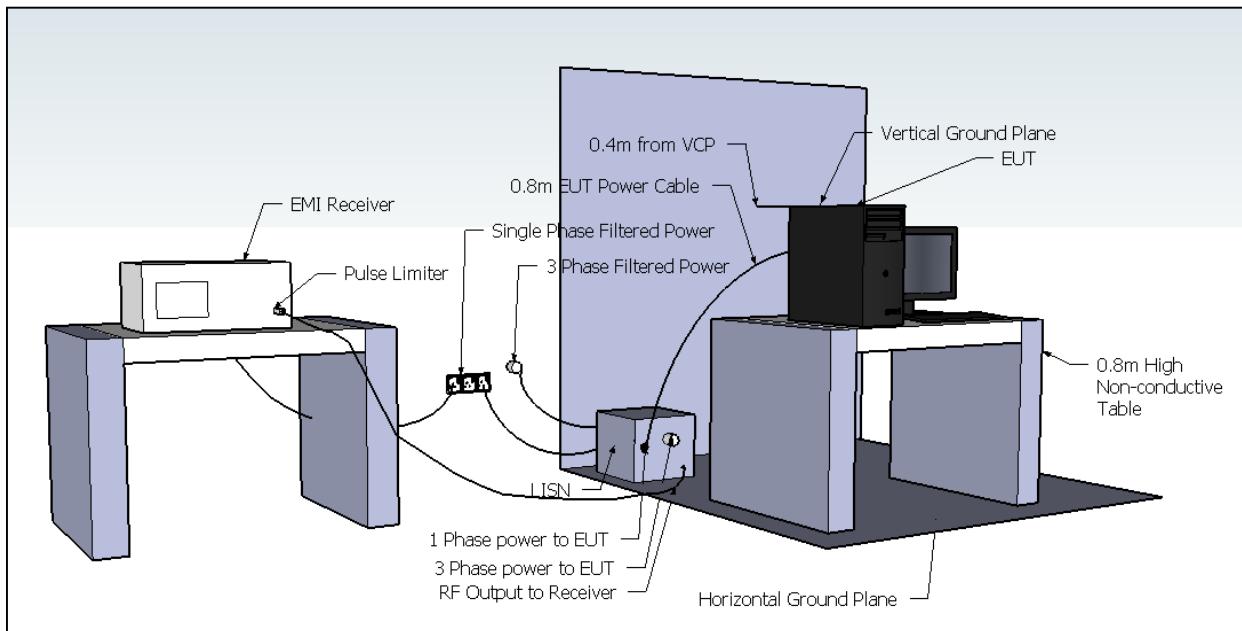


Figure 2: Typical test setup for conducted emission test

### 5.3.1.4 TEST PROCEDURE

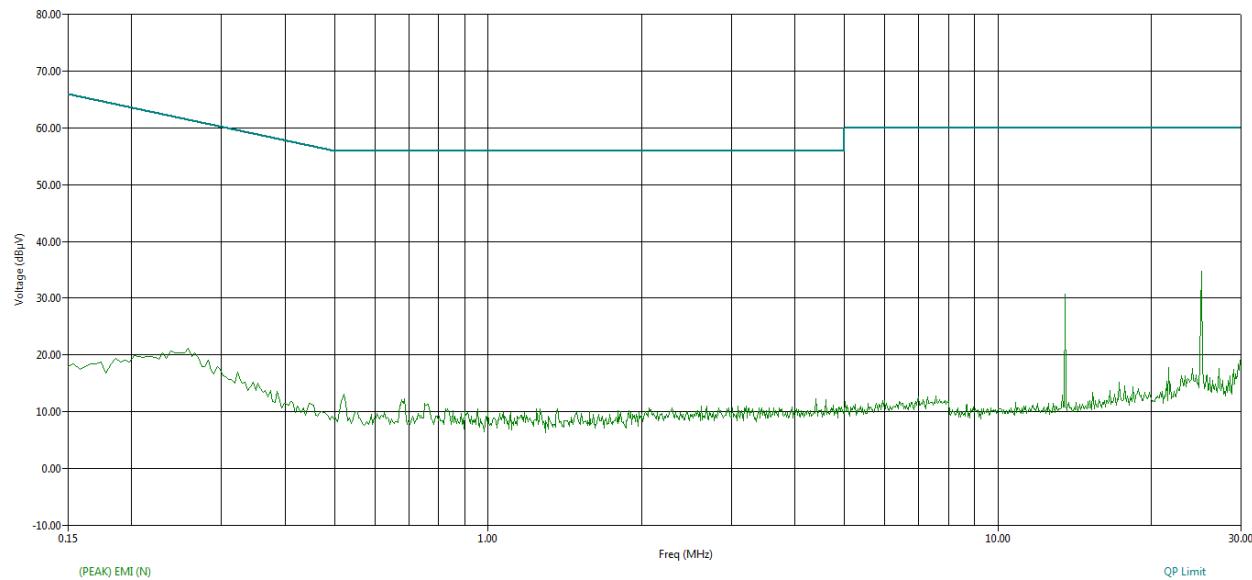
The test procedure is in accordance with ANSI C63.4-2014. The Conducted Emission test was performed in the test site with a horizontal ground reference plane and a vertical ground reference plane bonded together. The EUT was placed on a 0.8 m height non-metallic wooden table. The power supply to the EUT was feed through a LISN ( $50 \Omega / 50 \mu H$ ). The conducted emission measurement test system was configured through software as per standard. The EUT was powered through power adapter and connected to LISN.

#### LISN (Voltage Method):

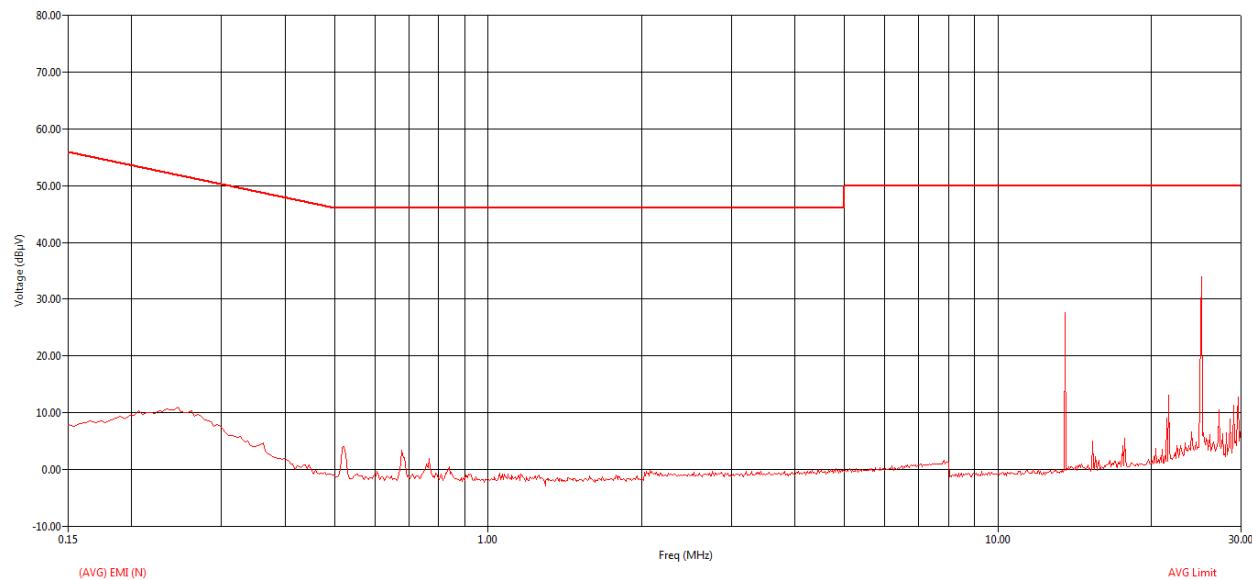
The conducted RF emission coupled to the RF port of the LISN was measured using an EMI receiver. Pre-scan was carried out in max hold mode and conducted emission from the EUT through the Power line was plotted in the Graph. The predominant peaks at various frequencies closer to limit line and above the limit line were identified using peak search option and listed. The Quasi-peak and Average measurement was carried out for the listed frequencies and compared with the limit specified in standard.

### 5.3.1.5 MEASUREMENT GRAPHS AND DATA

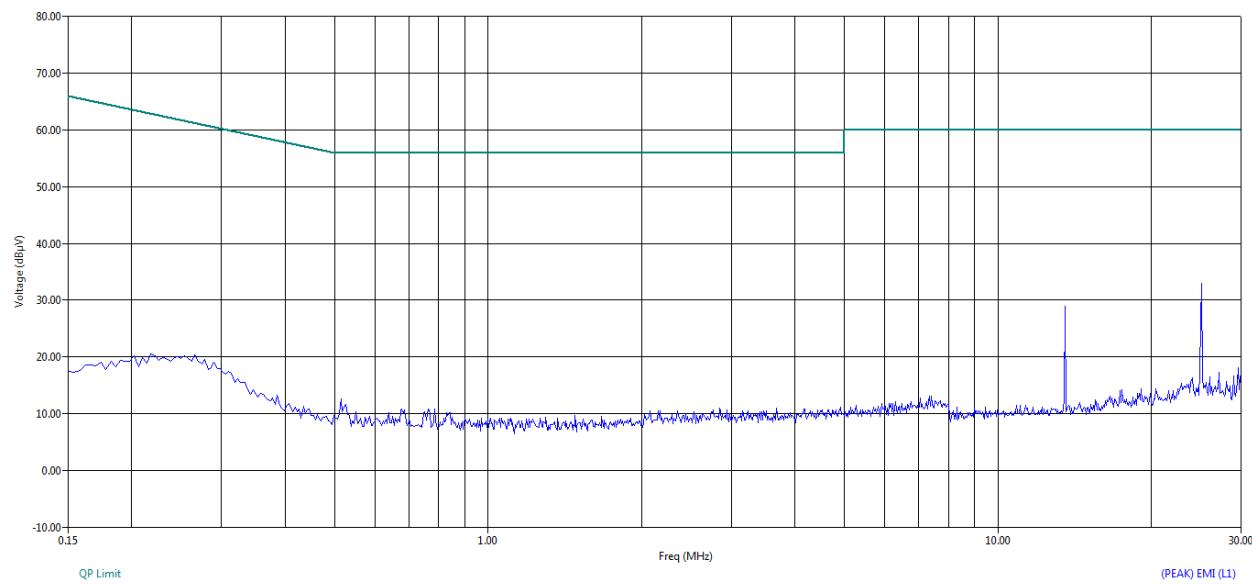
#### LOW CHANNEL \_ CONTINUOUS TX



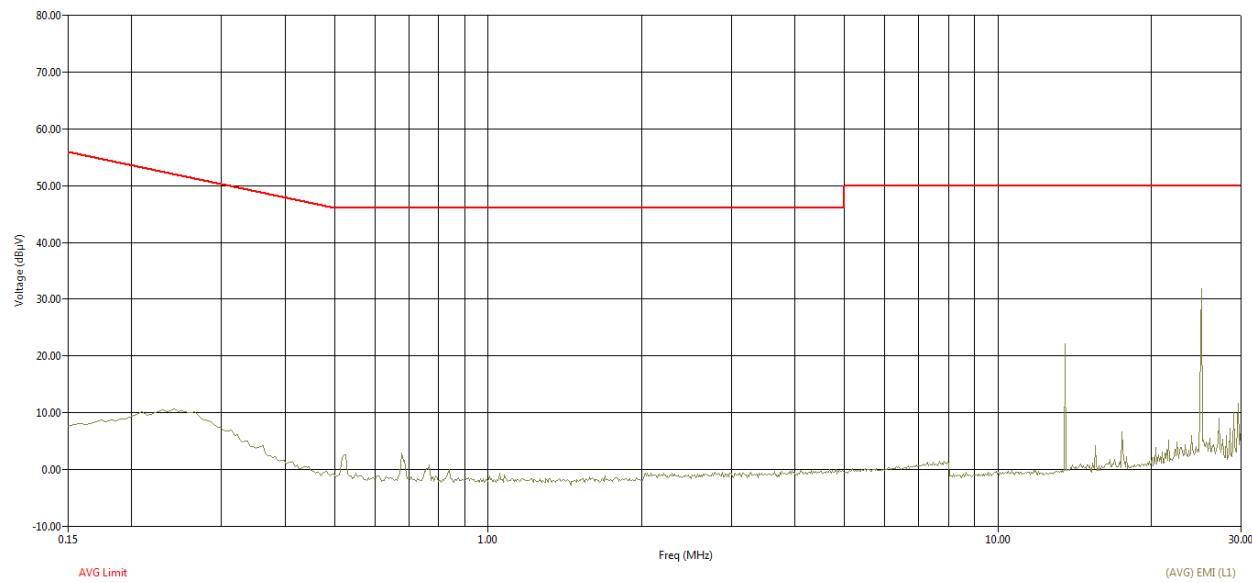
**Figure 3: CE graph from 150 kHz to 30 MHz using Peak detector - Neutral**



**Figure 4: CE graph from 150 kHz to 30 MHz using Average detector - Neutral**



**Figure 5: CE graph from 150 kHz to 30 MHz using Peak detector - Line**



**Figure 6: CE graph from 150 kHz to 30 MHz using Average detector – Line**

Freq (MHz)	Freq (Max) (MHz)	Line	(AVG) Trace (dB $\mu$ V)	Transducer N (dB)	Transducer L (dB)	Cable + Pulse limiter (dB)	(AVG) EMI (dB $\mu$ V)	(AVG) Limit (dB $\mu$ V)	(AVG) Margin (dB)
0.2180	0.22	L1	-0.43	0.00	0.07	10.11	9.74	52.89	-43.15
0.2580	0.25	N	-0.08	0.10	0.00	10.10	10.13	51.73	-41.60
0.5200	0.52	L1	-6.60	0.00	0.06	10.10	3.57	46.00	-42.43
0.5200	0.51	N	-9.84	0.10	0.00	10.10	0.36	46.00	-45.64
13.5620	13.56	N	5.86	0.29	0.00	10.30	16.45	50.00	-33.55
13.5620	13.56	L1	6.01	0.00	0.25	10.30	16.56	50.00	-33.44
21.6700	21.67	N	-7.57	0.38	0.00	10.44	3.25	50.00	-46.75
24.0900	24.08	N	-8.15	0.38	0.00	10.50	2.73	50.00	-47.27
24.0900	24.09	L1	-7.66	0.00	0.36	10.50	3.21	50.00	-46.79
24.9060	24.91	L1	0.24	0.00	0.37	10.52	11.13	50.00	-38.87
24.9100	24.91	N	0.66	0.39	0.00	10.52	11.57	50.00	-38.43
24.9980	25.00	L1	1.10	0.00	0.37	10.52	11.99	50.00	-38.01
25.0020	25.00	N	0.38	0.39	0.00	10.52	11.29	50.00	-38.71
25.0580	25.06	N	22.34	0.39	0.00	10.52	33.24	50.00	-16.76
25.0580	25.06	L1	22.19	0.00	0.37	10.52	33.08	50.00	-16.92
29.5700	29.57	N	-3.82	0.40	0.00	10.54	7.12	50.00	-42.88
29.5700	29.57	L1	-3.55	0.00	0.41	10.54	7.40	50.00	-42.60
29.8820	29.88	N	-6.51	0.40	0.00	10.54	4.43	50.00	-45.57

**Table 3: Average table for CE from 150 kHz to 30 MHz – Line & Neutral**

Freq (MHz)	Freq (Max) (MHz)	Line	(QP) Trace (dB $\mu$ V)	Transducer N (dB)	Transducer L (dB)	Cable + Pulse limiter (dB)	(QP) EMI (dB $\mu$ V)	(QP) Limit (dB $\mu$ V)	(QP) Margin (dB)
0.2180	0.22	L1	5.56	0.00	0.07	10.11	15.73	62.89	-47.16
0.2580	0.25	N	5.98	0.10	0.00	10.10	16.19	61.73	-45.54
0.5200	0.52	L1	-2.34	0.00	0.06	10.10	7.82	56.00	-48.18
0.5200	0.51	N	-4.50	0.10	0.00	10.10	5.70	56.00	-50.30
13.5620	13.56	N	17.00	0.29	0.00	10.30	27.59	60.00	-32.41
13.5620	13.56	L1	17.70	0.00	0.25	10.30	28.26	60.00	-31.74
21.6700	21.67	N	-0.91	0.38	0.00	10.44	9.91	60.00	-50.09
24.0900	24.08	N	-1.70	0.38	0.00	10.50	9.18	60.00	-50.82
24.0900	24.09	L1	-1.27	0.00	0.36	10.50	9.59	60.00	-50.41
24.9060	24.91	L1	4.65	0.00	0.37	10.52	15.53	60.00	-44.47
24.9100	24.91	N	4.35	0.39	0.00	10.52	15.25	60.00	-44.75
24.9980	25.00	L1	4.32	0.00	0.37	10.52	15.21	60.00	-44.79
25.0020	25.00	N	3.80	0.39	0.00	10.52	14.71	60.00	-45.29
25.0580	25.06	N	22.99	0.39	0.00	10.52	33.90	60.00	-26.10
25.0580	25.06	L1	22.45	0.00	0.37	10.52	33.34	60.00	-26.66
29.5700	29.57	N	3.47	0.40	0.00	10.54	14.41	60.00	-45.59
29.5700	29.57	L1	3.50	0.00	0.41	10.54	14.45	60.00	-45.55
29.8820	29.88	N	-1.06	0.40	0.00	10.54	9.88	60.00	-50.12

**Table 4: Quasi Peak table for CE from 150 kHz to 30 MHz – Line & Neutral**

**Note:**

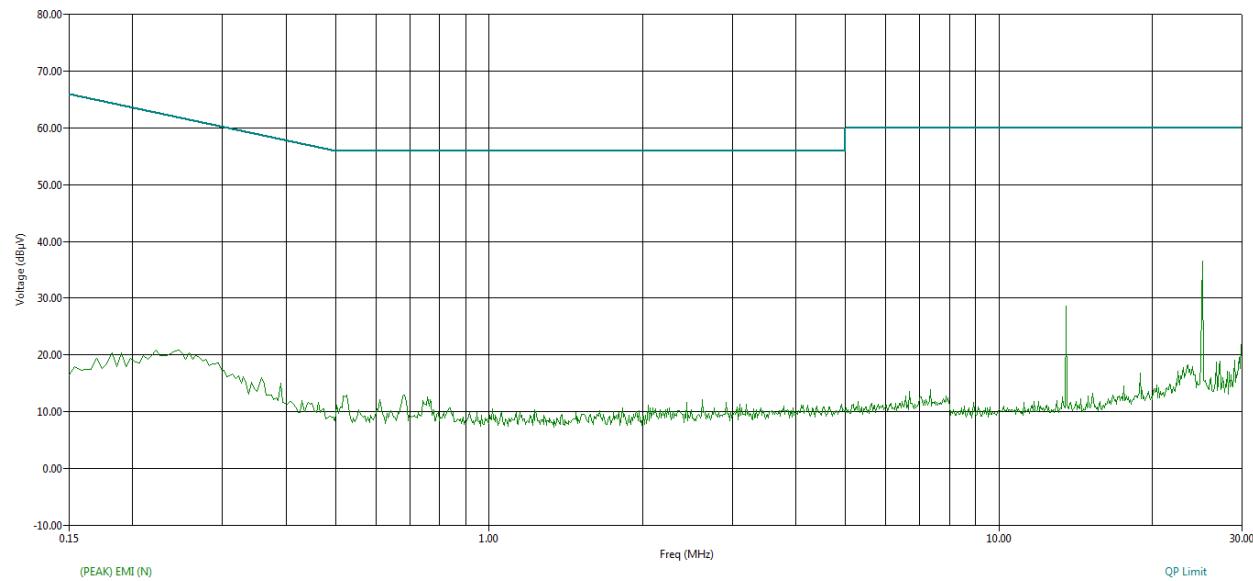
$QP\ EMI\ (dB\mu V/m) = QP\ Trace\ (dB\mu V) + Cable\ (dB) + Transducer\ (dB/m) - Preamp\ (dB)$

$QP\ Margin\ (dB) = QP\ EMI\ (dB\mu V/m) - Limit\ (dB\mu V/m)$

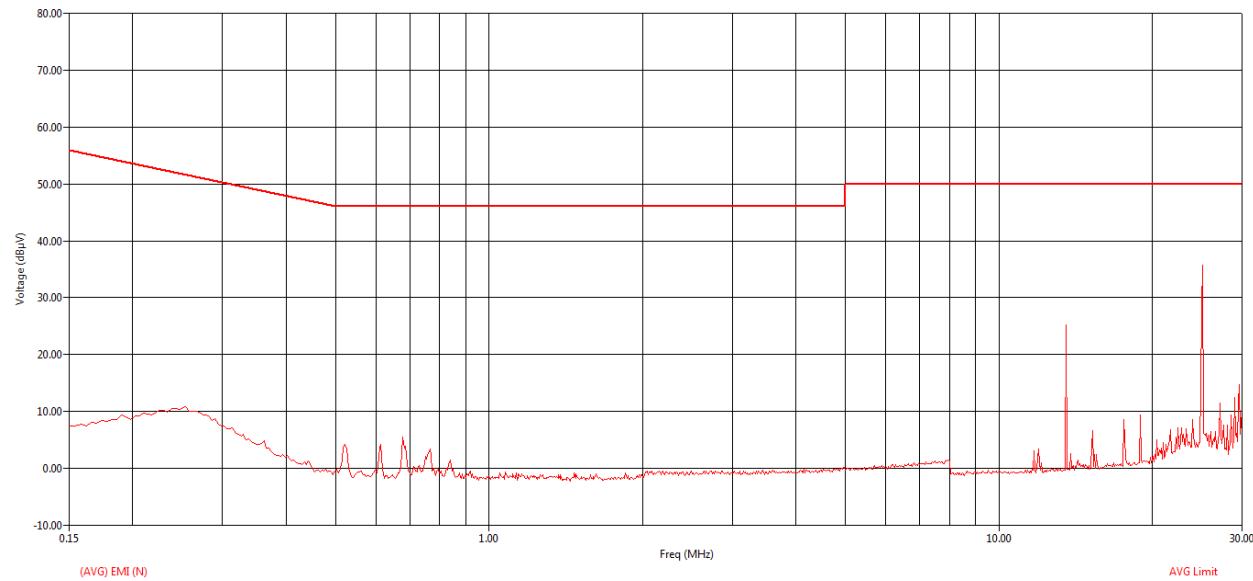
$AVERAGE\ EMI\ (dB\mu V/m) = AVERAGE\ Trace\ (dB\mu V) + Cable\ (dB) + Transducer\ (dB/m) - Preamp\ (dB)$

$AVERAGE\ Margin\ (dB) = AVERAGE\ EMI\ (dB\mu V/m) - Limit\ (dB\mu V/m)$

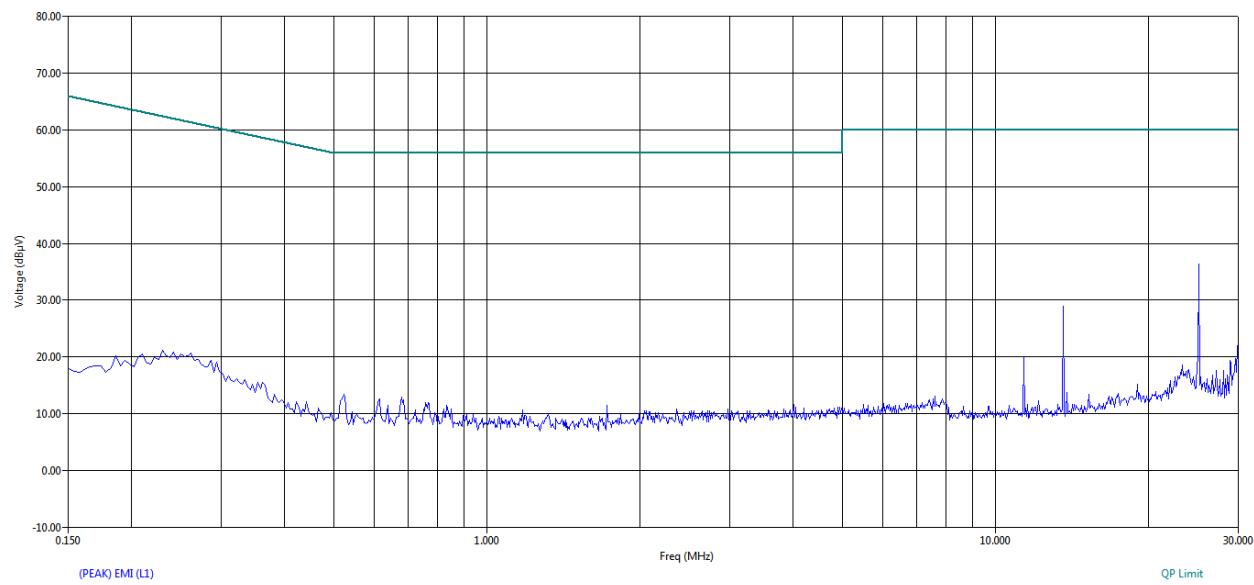
## MID CHANNEL \_CONTINUOUS TX



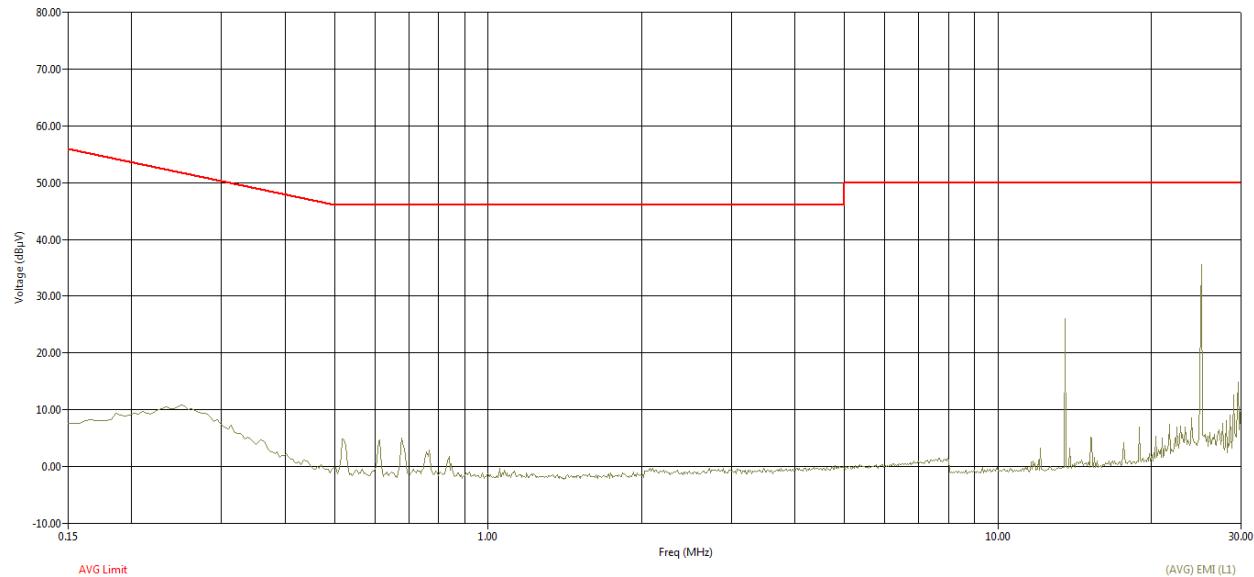
**Figure 7: CE graph from 150 kHz to 30 MHz using Peak detector - Neutral**



**Figure 8: CE graph from 150 kHz to 30 MHz using Average detector - Neutral**



**Figure 9: CE graph from 150 kHz to 30 MHz using Peak detector - Line**



**Figure 10: CE graph from 150 kHz to 30 MHz using Average detector – Line**

Freq (MHz)	Freq (Max) (MHz)	Line	(AVG) Trace (dB $\mu$ V)	Cable + Pulse limiter (dB)	Transducer N (dB)	Transducer L (dB)	(AVG) EMI (dB $\mu$ V)	(AVG) Limit (dB $\mu$ V)	(AVG) Margin AVL (dB)
0.2220	0.23	N	-0.13	10.10	0.10	0.00	10.07	52.57	-42.50
0.2300	0.23	L1	-0.05	10.10	0.00	0.06	10.12	52.41	-42.29
0.5200	0.52	N	-5.89	10.10	0.10	0.00	4.31	46.00	-41.69
0.5200	0.52	L1	-5.68	10.10	0.00	0.06	4.48	46.00	-41.52
11.3740	11.37	L1	-11.77	10.23	0.00	0.22	-1.31	50.00	-51.31
13.5620	13.56	N	4.81	10.30	0.29	0.00	15.40	50.00	-34.60
13.5620	13.56	L1	4.96	10.30	0.00	0.25	15.51	50.00	-34.49
23.3260	23.33	L1	-3.86	10.48	0.00	0.35	6.97	50.00	-43.03
23.5060	23.51	N	-8.12	10.49	0.38	0.00	2.75	50.00	-47.25
24.9100	24.91	N	3.04	10.52	0.39	0.00	13.95	50.00	-36.05
24.9100	24.91	L1	2.88	10.52	0.00	0.37	13.76	50.00	-36.24
24.9980	25.00	L1	1.93	10.52	0.00	0.37	12.82	50.00	-37.18
25.0020	25.00	N	3.90	10.52	0.39	0.00	14.81	50.00	-35.19
25.0580	25.06	N	24.92	10.52	0.39	0.00	35.83	50.00	-14.17
25.0580	25.06	L1	24.55	10.52	0.00	0.37	35.44	50.00	-14.56
26.6660	26.66	N	-9.15	10.53	0.39	0.00	1.77	50.00	-48.23
27.1220	27.12	N	-5.48	10.53	0.39	0.00	5.44	50.00	-44.56
28.8900	28.89	L1	-9.72	10.54	0.00	0.40	1.22	50.00	-48.78
29.0700	29.07	N	-2.75	10.54	0.40	0.00	8.18	50.00	-41.82

**Table 5: Average table for CE from 150 kHz to 30 MHz – Line & Neutral**

Freq (MHz)	Freq (Max) (MHz)	Line	(QP) Trace (dB $\mu$ V)	Cable + Pulse limiter (dB)	Transducer N (dB)	Transducer L (dB)	(QP) EMI (dB $\mu$ V)	(QP) Limit (dB $\mu$ V)	(QP) Margin (dB)
0.2220	0.23	N	5.78	10.10	0.10	0.00	15.98	62.57	-46.59
0.2300	0.23	L1	5.94	10.10	0.00	0.06	16.11	62.41	-46.30
0.5200	0.52	N	-0.80	10.10	0.10	0.00	9.40	56.00	-46.60
0.5200	0.52	L1	-0.46	10.10	0.00	0.06	9.70	56.00	-46.30
11.3740	11.37	L1	-6.01	10.23	0.00	0.22	4.44	60.00	-55.56
13.5620	13.56	N	16.01	10.30	0.29	0.00	26.60	60.00	-33.40
13.5620	13.56	L1	15.59	10.30	0.00	0.25	26.14	60.00	-33.86
23.3260	23.33	L1	1.52	10.48	0.00	0.35	12.35	60.00	-47.65
23.5060	23.51	N	-0.91	10.49	0.38	0.00	9.96	60.00	-50.04
24.9100	24.91	N	5.82	10.52	0.39	0.00	16.73	60.00	-43.27
24.9100	24.91	L1	5.73	10.52	0.00	0.37	16.61	60.00	-43.39
24.9980	25.00	L1	5.27	10.52	0.00	0.37	16.16	60.00	-43.84
25.0020	25.00	N	6.41	10.52	0.39	0.00	17.32	60.00	-42.66
25.0580	25.06	N	25.12	10.52	0.39	0.00	36.02	60.00	-23.98
25.0580	25.06	L1	24.99	10.52	0.00	0.37	35.88	60.00	-24.12
26.6660	26.66	N	-1.81	10.53	0.39	0.00	9.10	60.00	-50.90
27.1220	27.12	N	2.04	10.53	0.39	0.00	12.96	60.00	-47.04
28.8900	28.89	L1	2.22	10.54	0.00	0.40	8.72	60.00	-51.28
29.0700	29.07	N	4.48	10.54	0.40	0.00	15.42	60.00	-44.58

**Table 6: Quasi Peak table for CE from 150 kHz to 30 MHz – Line & Neutral**
**Note:**

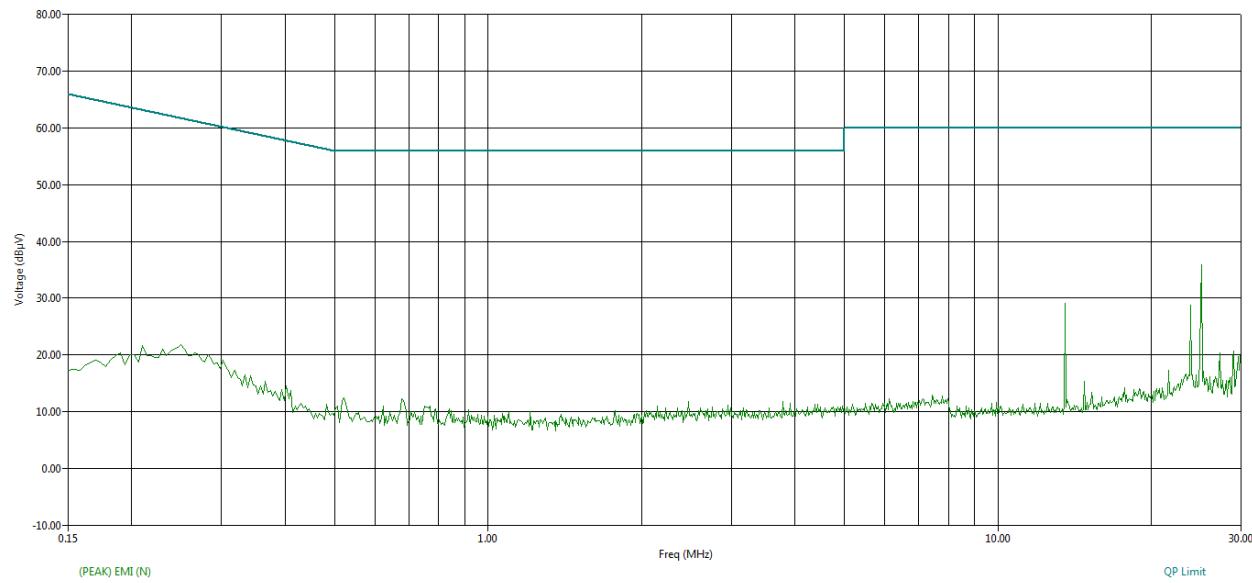
$$QP\ EMI\ (dB\mu V/m) = QP\ Trace\ (dB\mu V) + Cable\ (dB) + Transducer\ (dB/m) - Preamp\ (dB)$$

$$QP\ Margin\ (dB) = QP\ EMI\ (dB\mu V/m) - Limit\ (dB\mu V/m)$$

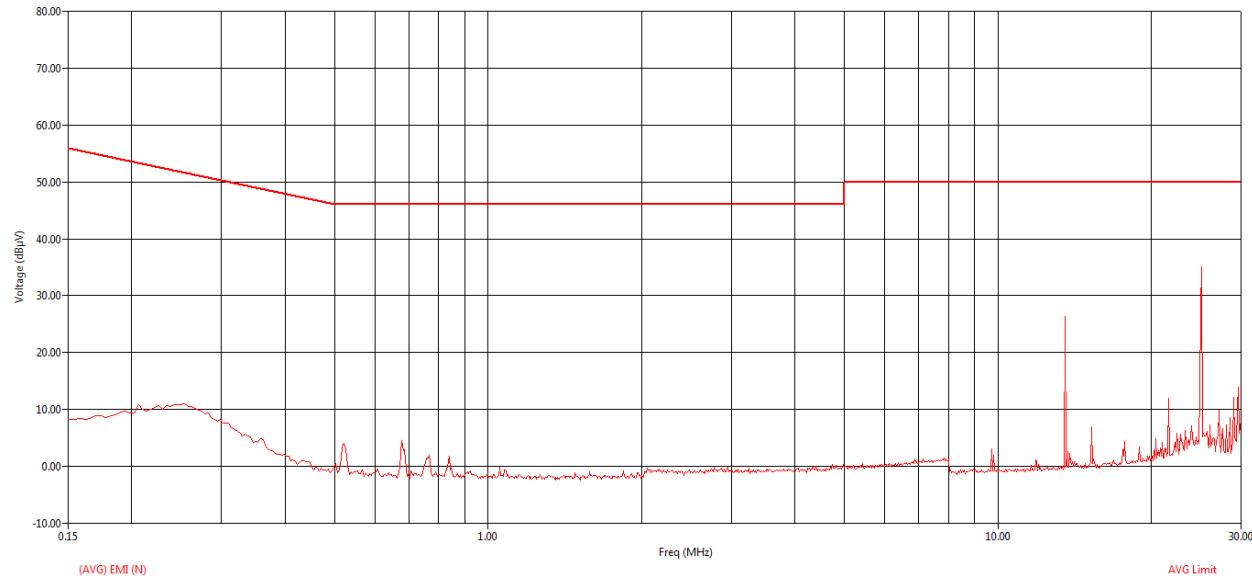
$$AVERAGE\ EMI\ (dB\mu V/m) = AVERAGE\ Trace\ (dB\mu V) + Cable\ (dB) + Transducer\ (dB/m) - Preamp\ (dB)$$

$$AVERAGE\ Margin\ (dB) = AVERAGE\ EMI\ (dB\mu V/m) - Limit\ (dB\mu V/m)$$

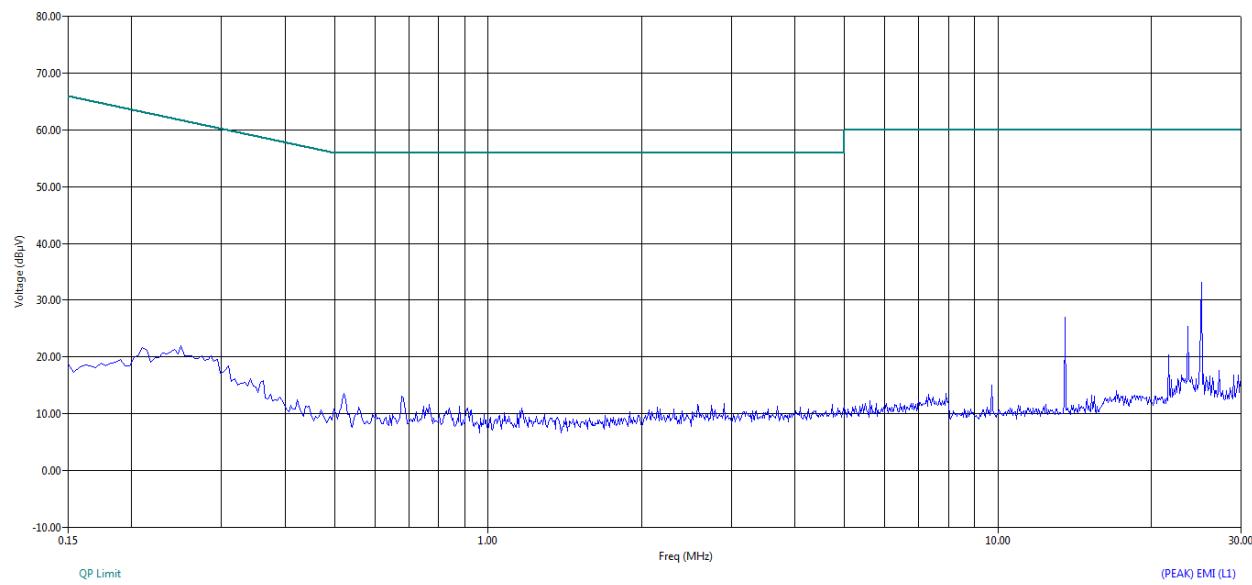
## HIGH CHANNEL\_ CONTINUOUS TX



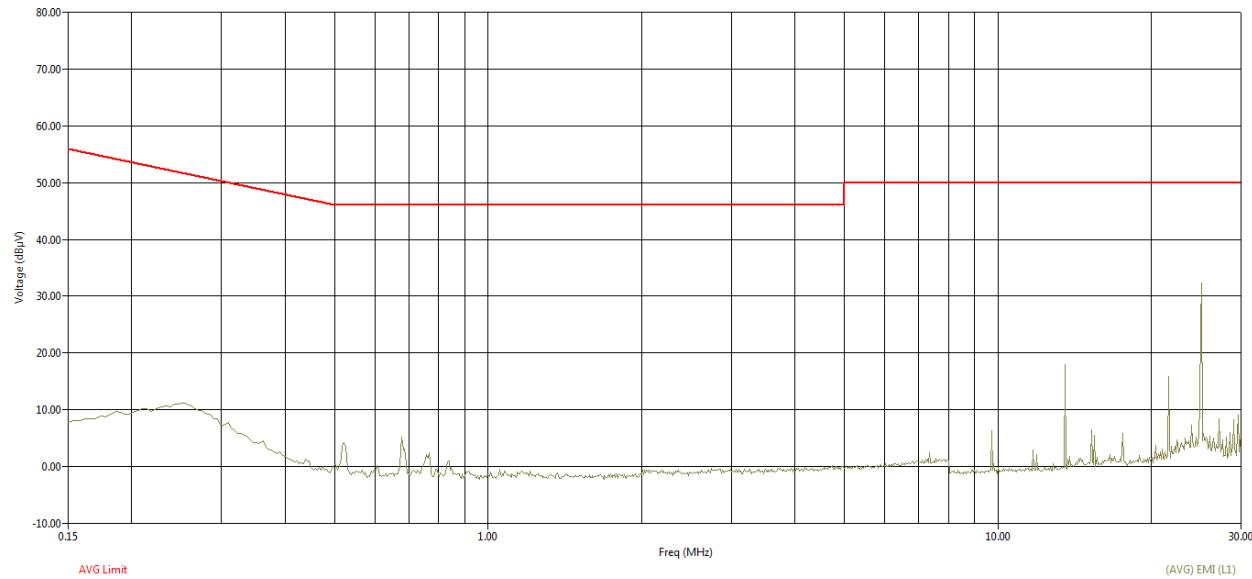
**Figure 11: CE graph from 150 kHz to 30 MHz using Peak detector - Neutral**



**Figure 12: CE graph from 150 kHz to 30 MHz using Average detector - Neutral**



**Figure 13: CE graph from 150 kHz to 30 MHz using Peak detector - Line**



**Figure 14: CE graph from 150 kHz to 30 MHz using Average detector – Line**

Freq (MHz)	Freq (Max) (MHz)	Line	(AVG) Trace (dB $\mu$ V)	Cable + Pulse limiter (dB)	Transducer N (dB)	Transducer L (dB)	(AVG) EMI (dB $\mu$ V)	(AVG) Limit (dB $\mu$ V)	(AVG) Margin AVL (dB)
0.2500	0.25	N	0.74	10.10	0.10	0.00	10.95	51.75	-40.80
0.2500	0.24	L1	0.34	10.10	0.00	0.06	10.51	52.03	-41.52
0.5200	0.52	N	-6.58	10.10	0.10	0.00	3.62	46.00	-42.38
0.5200	0.52	L1	-5.86	10.10	0.00	0.06	4.30	46.00	-41.70
13.5580	13.56	L1	6.49	10.30	0.00	0.25	17.05	50.00	-32.95
13.5620	13.56	N	6.51	10.30	0.29	0.00	17.10	50.00	-32.90
21.6700	21.67	L1	-2.45	10.44	0.00	0.34	8.33	50.00	-41.67
22.8940	22.90	L1	-8.76	10.47	0.00	0.35	2.06	50.00	-47.94
23.6180	23.62	L1	-9.10	10.49	0.00	0.36	1.75	50.00	-48.25
23.9380	23.95	N	-6.73	10.50	0.38	0.00	4.15	50.00	-45.85
24.9100	24.91	N	3.12	10.52	0.39	0.00	14.02	50.00	-35.98
24.9100	24.91	L1	3.51	10.52	0.00	0.37	14.39	50.00	-35.61
24.9980	25.00	N	4.90	10.52	0.39	0.00	15.81	50.00	-34.19
25.0020	25.00	L1	4.48	10.52	0.00	0.37	15.37	50.00	-34.63
25.0580	25.06	N	26.14	10.52	0.39	0.00	37.05	50.00	-12.95
25.0580	25.06	L1	26.18	10.52	0.00	0.37	37.07	50.00	-12.93
26.4380	26.44	L1	-9.36	10.53	0.00	0.38	1.55	50.00	-48.45
27.1220	27.12	L1	-4.59	10.53	0.00	0.39	6.33	50.00	-43.67
27.2340	27.23	N	-9.22	10.53	0.39	0.00	1.71	50.00	-48.29

**Table 7: Average table for CE from 150 kHz to 30 MHz – Line & Neutral**

Freq (MHz)	Freq (Max) (MHz)	Line	(QP) Trace (dB $\mu$ V)	Cable + Pulse limiter (dB)	Transducer N (dB)	Transducer L (dB)	(QP) EMI (dB $\mu$ V)	(QP) Limit (dB $\mu$ V)	(QP) Margin QPL (dB)
0.2500	0.25	N	6.80	10.10	0.10	0.00	17.00	61.75	-44.75
0.2500	0.24	L1	6.30	10.10	0.00	0.06	16.47	62.03	-45.56
0.5200	0.52	N	-1.70	10.10	0.10	0.00	8.50	56.00	-47.50
0.5200	0.52	L1	-0.91	10.10	0.00	0.06	9.26	56.00	-46.74
13.5580	13.56	L1	17.93	10.30	0.00	0.25	28.48	60.00	-31.52
13.5620	13.56	N	17.90	10.30	0.29	0.00	28.50	60.00	-31.50
21.6700	21.67	L1	2.50	10.44	0.00	0.34	13.28	60.00	-46.72
22.8940	22.90	L1	-2.46	10.47	0.00	0.35	8.36	60.00	-51.64
23.6180	23.62	L1	-2.52	10.49	0.00	0.36	8.33	60.00	-51.67
23.9380	23.95	N	-1.16	10.50	0.38	0.00	9.72	60.00	-50.28
24.9100	24.91	N	5.85	10.52	0.39	0.00	16.75	60.00	-43.25
24.9100	24.91	L1	5.96	10.52	0.00	0.37	16.85	60.00	-43.15
24.9980	25.00	N	7.50	10.52	0.39	0.00	18.41	60.00	-41.59
25.0020	25.00	L1	7.26	10.52	0.00	0.37	18.15	60.00	-41.85
25.0580	25.06	N	26.35	10.52	0.39	0.00	37.25	60.00	-22.75
25.0580	25.06	L1	26.36	10.52	0.00	0.37	37.25	60.00	-22.75
26.4380	26.44	L1	-2.89	10.53	0.00	0.38	8.01	60.00	-51.99
27.1220	27.12	L1	3.32	10.53	0.00	0.39	14.23	60.00	-45.77
27.2340	27.23	N	-2.71	10.53	0.39	0.00	8.22	60.00	-51.78

**Table 8: Quasi Peak table for CE from 150 kHz to 30 MHz – Line & Neutral**

**Note:**

$QP\ EMI\ (dB\mu V/m) = QP\ Trace\ (dB\mu V) + Cable\ (dB) + Transducer\ (dB/m) - Preamp\ (dB)$

$QP\ Margin\ (dB) = QP\ EMI\ (dB\mu V/m) - Limit\ (dB\mu V/m)$

$AVERAGE\ EMI\ (dB\mu V/m) = AVERAGE\ Trace\ (dB\mu V) + Cable\ (dB) + Transducer\ (dB/m) - Preamp\ (dB)$

$AVERAGE\ Margin\ (dB) = AVERAGE\ EMI\ (dB\mu V/m) - Limit\ (dB\mu V/m)$

### 5.3.1.6 RESULT

Conducted Emissions from the EUT are within the specified Limit line.

## 5.3.2 RADIATED EMISSIONS

### 5.3.2.1 TEST SPECIFICATIONS

<b>Test Standard</b>	47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C RSS-Gen, Issue 4, Nov 2014, RSS 247 Issue 1 May 2015			
<b>Test Procedure</b>	ANSI C63.4-2014;ANSI C63.10-2013			
<b>Frequency Range</b>	9 kHz to 150 kHz	150 kHz to 30 MHz	30 MHz to 1 GHz	1 GHz to 26.5 GHz
<b>Resolution Bandwidth</b>	1 kHz	10 kHz	120 kHz	1 MHz
<b>Video Bandwidth</b>	3 kHz	30 kHz	300 kHz	3 MHz
<b>Step size</b>	400Hz	4 kHz	40 kHz	400 kHz
<b>Pre Scan Measurement Time</b>	50ms	50ms	20ms	5ms
<b>Final Measurement Time</b>	1 s	1 s	1 s	1 s
<b>Attenuation</b>	10 dB	10 dB	10 dB	4 dB
<b>Test Distance</b>	3 m	3 m	3 m	3 m
<b>Polarization</b>	Parallel & Perpendicular		Horizontal and Vertical	
<b>Detector</b>	Average & Quasi Peak		Quasi Peak & Average	Average
<b>Input Voltage</b>	3.6V DC			
<b>Input Frequency</b>	NA			
<b>Temperature</b>	22.1 °C	22.1 °C	23.6 °C	23.0 °C
<b>Humidity</b>	51.6 %	51.6 %	57.8 %	58 %
<b>Tested By</b>	Suresh. G.N	Suresh. G.N	Narendra	Narendra
<b>Test Date</b>	20 <sup>th</sup> Jun 2015	20 <sup>th</sup> Jun 2015	30 <sup>th</sup> May 2015	12 <sup>th</sup> Jun 2015

### 5.3.2.2 LIMITS

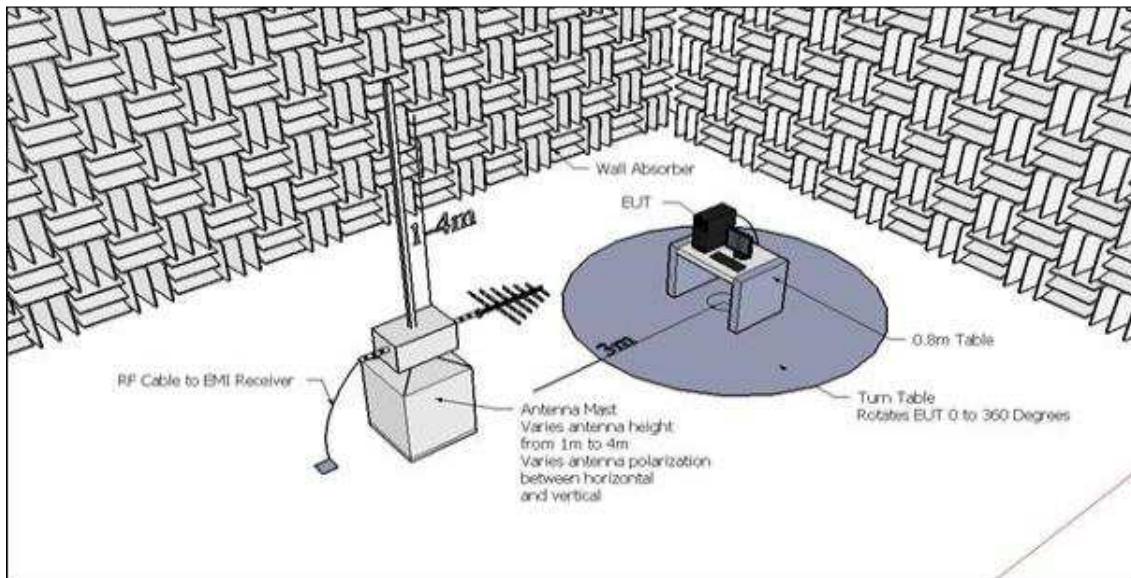
<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit (dB<math>\mu</math>V/m) at 3 meter</b>
47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C RSS-Gen, Issue 4, Nov 2014	§15.209 8.9 8.10	9 kHz to 490 kHz 490 kHz to 1.705 MHz 1.705 MHz to 30 MHz	128.51 to 93.80* 73.80 to 62.97* 69.54

Note: \* Decreases with the logarithm of the frequency

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit (dB<math>\mu</math>V/m) at 10 meter</b>
47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C RSS-Gen, Issue 4, Nov 2014	§15.209 8.9 8.10	30 MHz to 88 MHz 88 MHz to 216 MHz 216 MHz to 960 MHz 960 MHz to 1000 MHz	29.54 33.06 35.56 43.52

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit (dB<math>\mu</math>V/m) at 3 meter</b>
47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C RSS-Gen, Issue 4, Nov 2014	§15.209 8.9, 8.10	1000 MHz to 26.5 GHz	53.98

### 5.3.2.3 TEST SETUP



**Figure 15: Typical test setup for Radiated Emission test**

### 5.3.2.4 TEST PROCEDURE

The test procedure is in accordance with ANSI C63.4-2014 & ANSI C63.10-2013. The Radiated Emission test was performed inside a Semi-Anechoic chamber. The EUT was placed on a 0.8meter height non-metallic table for the frequency range below 1GHz and 1.5 meter height non-metallic table for the frequency range above 1GHz. The test setup was placed on a rotating turn table to enable 0 to 360 degree rotation.

The EUT was placed 3 meter away from the receiving antenna for the radiated emission measurement in the frequency range 9 kHz to 30MHz and 1GHz to 26.5 GHz and at 10 meter distance for the measurements in the frequency range 30MHz to 1GHz. The receiving antenna was mounted on an antenna mast to enable height variation from 1 to 4 meter above the ground plane for the frequency range 30 MHz to 1 GHz & 1 to 2 meter for frequency range 1 GHz to 26.5 GHz. A tunable band reject filter offering an attenuation 40 dB (approx.) was used to attenuate the intentional band during the testing.

The radiated emission measurement test system was configured through software as per standard. Pre-scan (Peak) was taken at different angle of EUT at 22.5 degree step, by rotating the turn table from 0 to 360 degree and by varying the antenna height from 1 to 4 meter in both vertical and horizontal polarization from 30 MHz to 1 GHz & 1 to 2 meter for 1 GHz to 26.5 GHz and in parallel & perpendicular orientation for 9 kHz to 30 MHz (using a loop antenna) with fixed height at 1 meter. The measurement was carried out in max hold mode and maximum amplitude of radiated emissions from the EUT was plotted in graph. The predominant peaks at various frequencies, which are closer to limit line were identified using peak search option and listed. The Quasi-peak measurement was carried out for the listed frequencies for the frequency range 30MHz to 1GHz. The average measurement was carried out for the listed frequency in the range of 1 GHz to 26.5 GHz.

### 5.3.2.5 MEASUREMENT GRAPHS / DATA

#### LOW CHANNEL CONTINUOUS TX

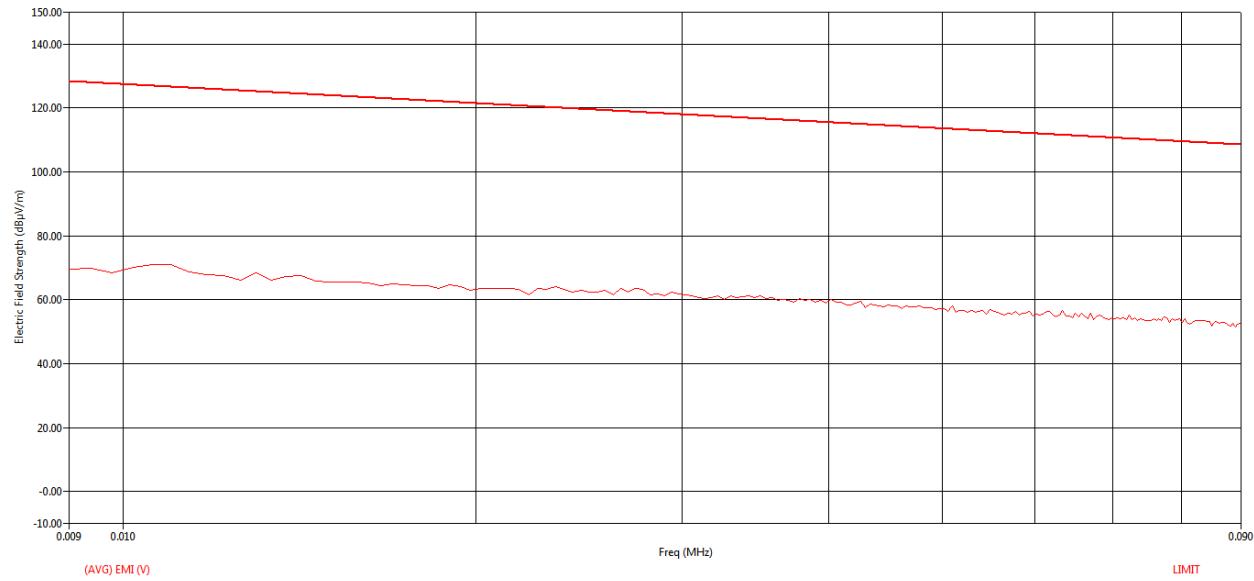


Figure 16: RE graph from 9 kHz to 90 kHz using average detector – Parallel

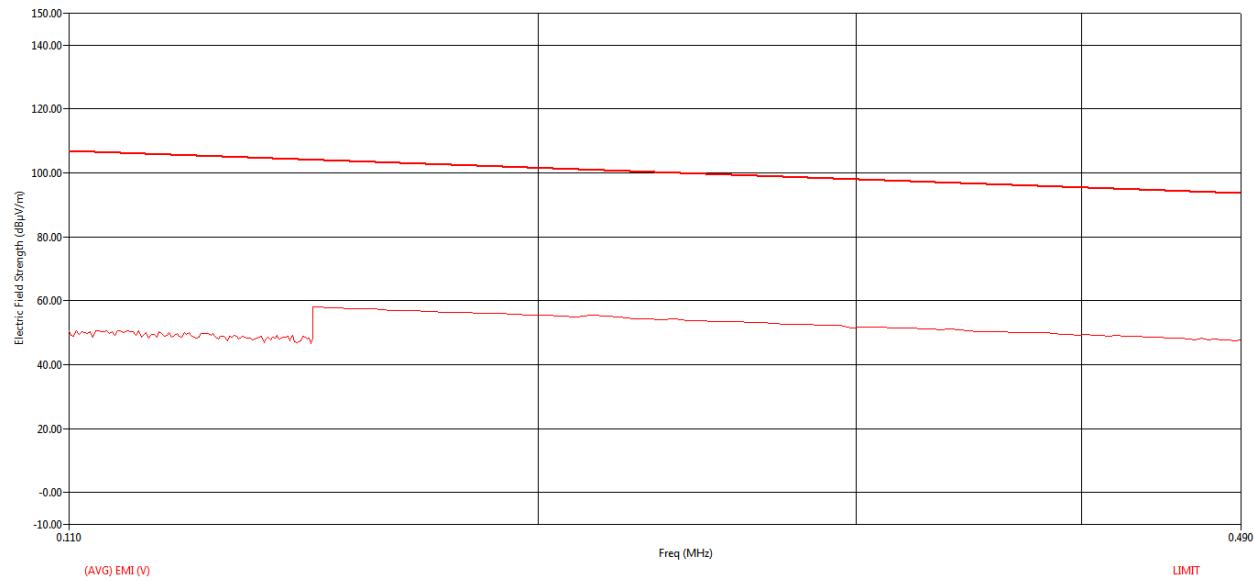
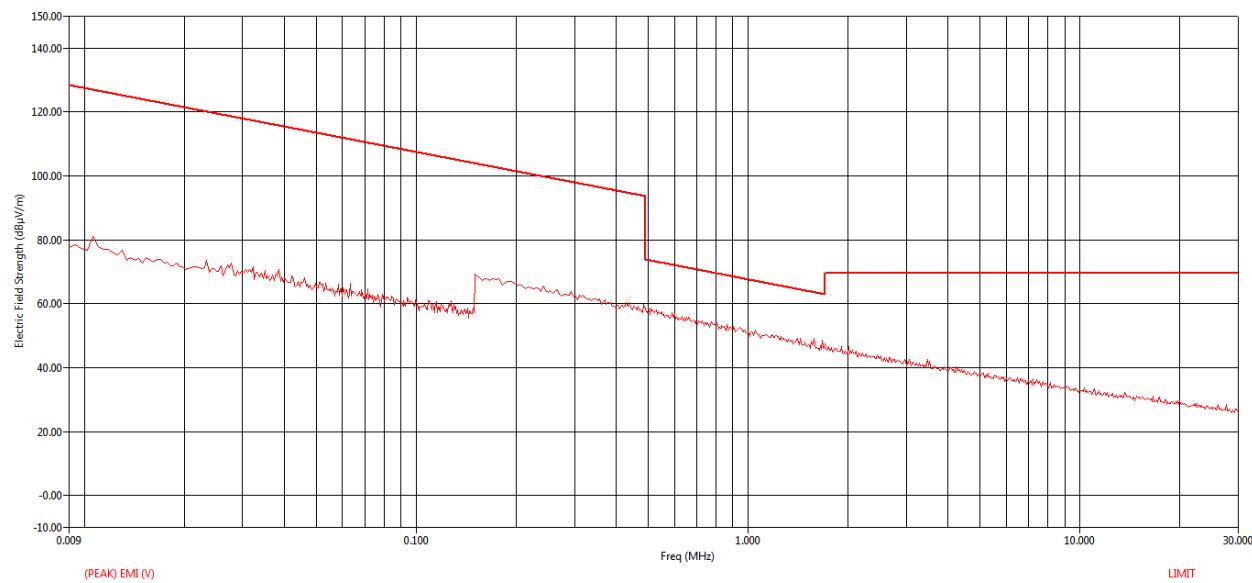


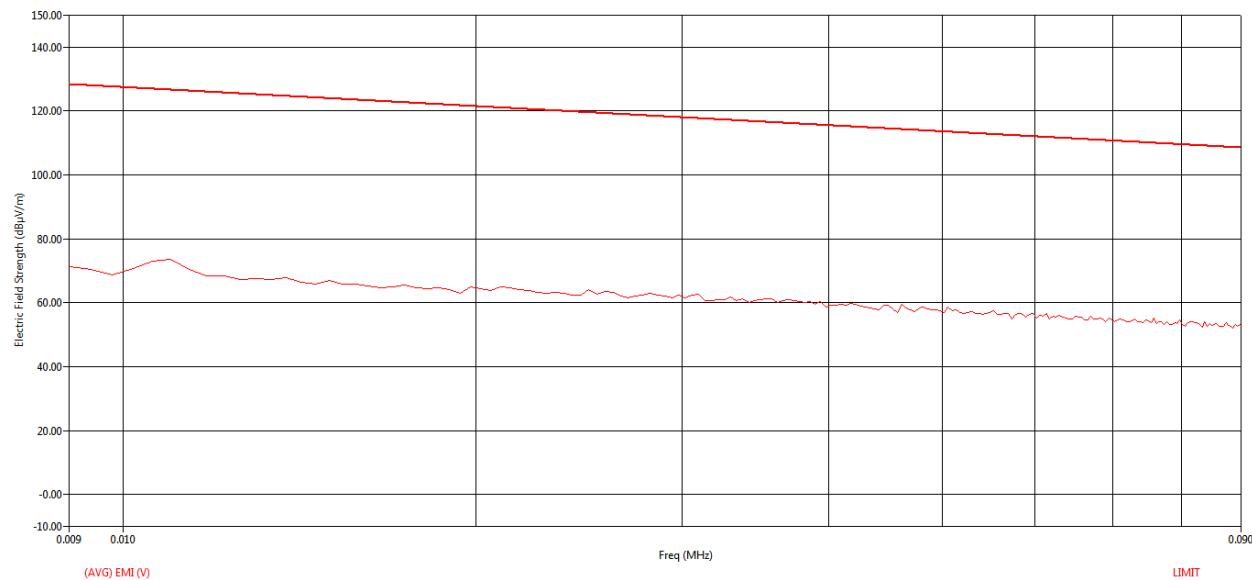
Figure 17: RE graph from 110 kHz to 490 kHz using average detector - Parallel



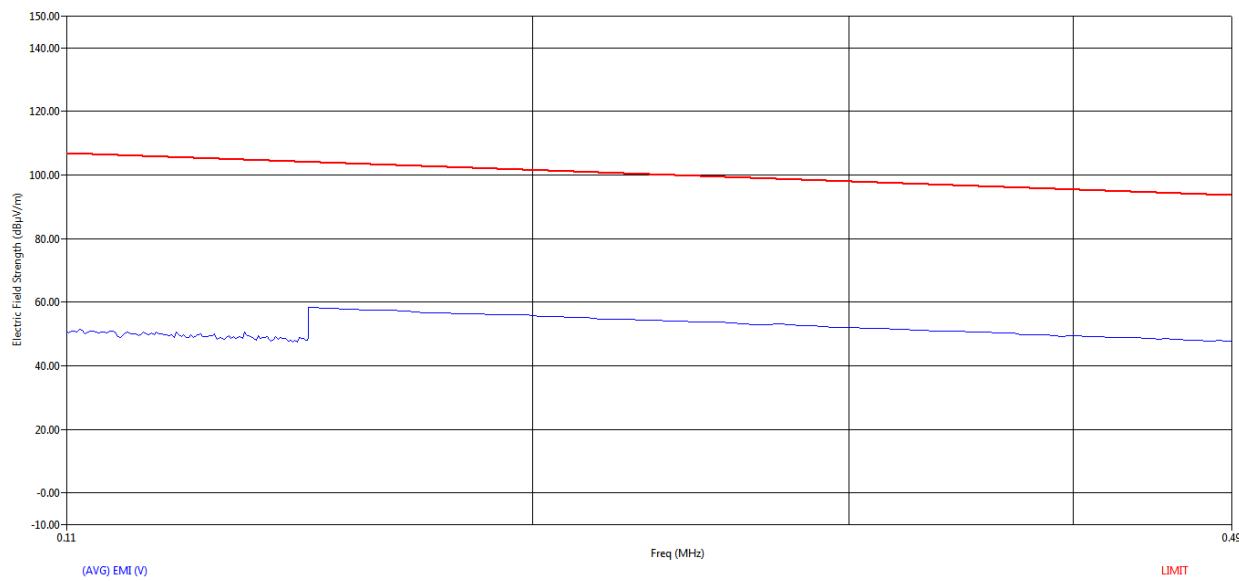
**Figure 18: RE graph from 9 kHz to 30 MHz using peak detector – Parallel**

Freq (MHz)	Freq (Max) (MHz)	Pol	EUT Ttbl Agl (deg)	(QP) Trace (dBμV)	Cable (dB)	Transducer (dB)	(QP) EMI (dBμV/m)	Limit (dBμV/m)	(QP) Margin (dB)
0.01	0.01	V	136.90	42.06	0.15	28.73	70.94	126.89	-55.95
0.45	0.45	V	288.30	35.87	0.21	17.50	53.58	94.48	-40.90

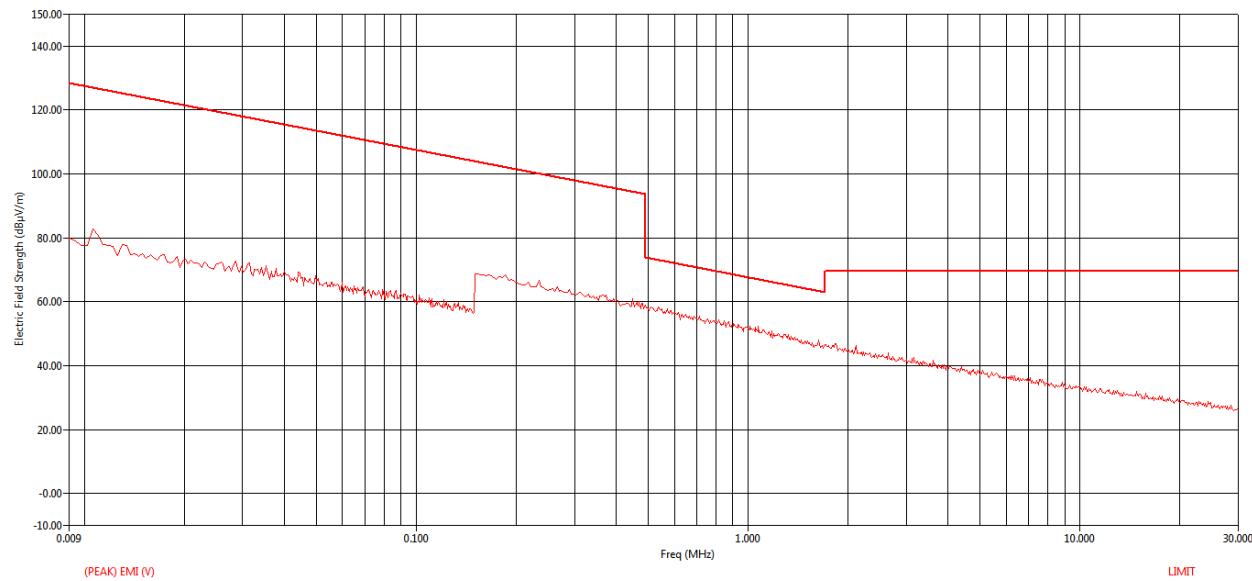
**Table 9: Quasi Peak table for RE from 9 kHz to 30 MHz - Parallel**



**Figure 19: RE graph from 9 kHz to 90 kHz using average detector – Perpendicular**



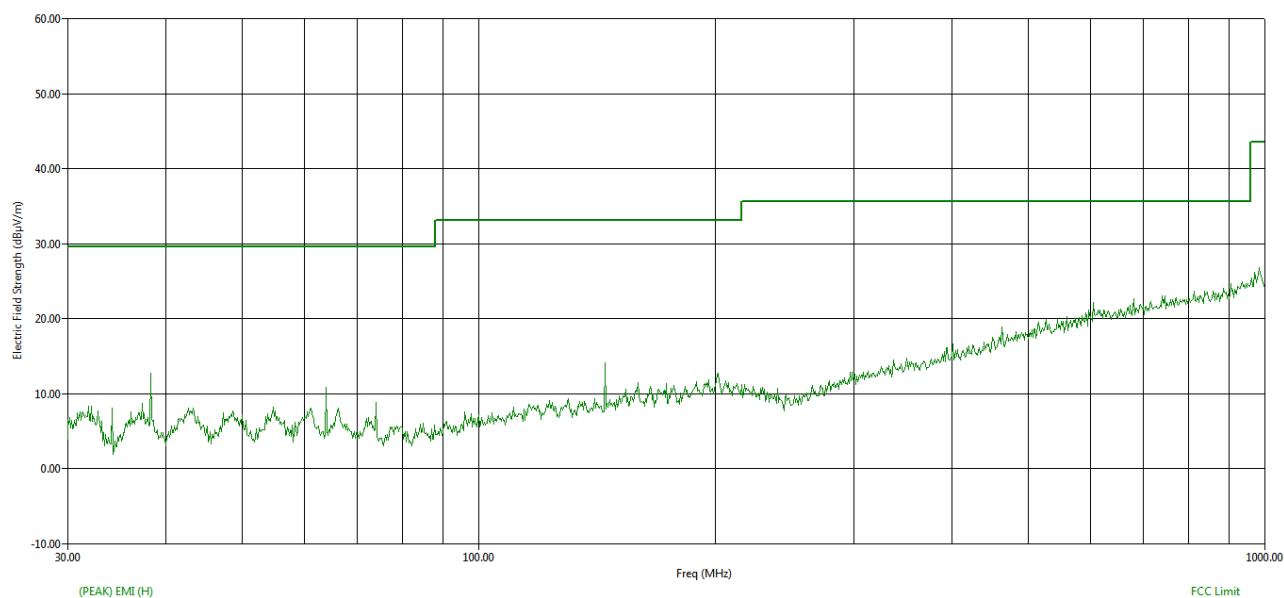
**Figure 20: RE graph from 110 kHz to 490 kHz using average detector - Perpendicular**



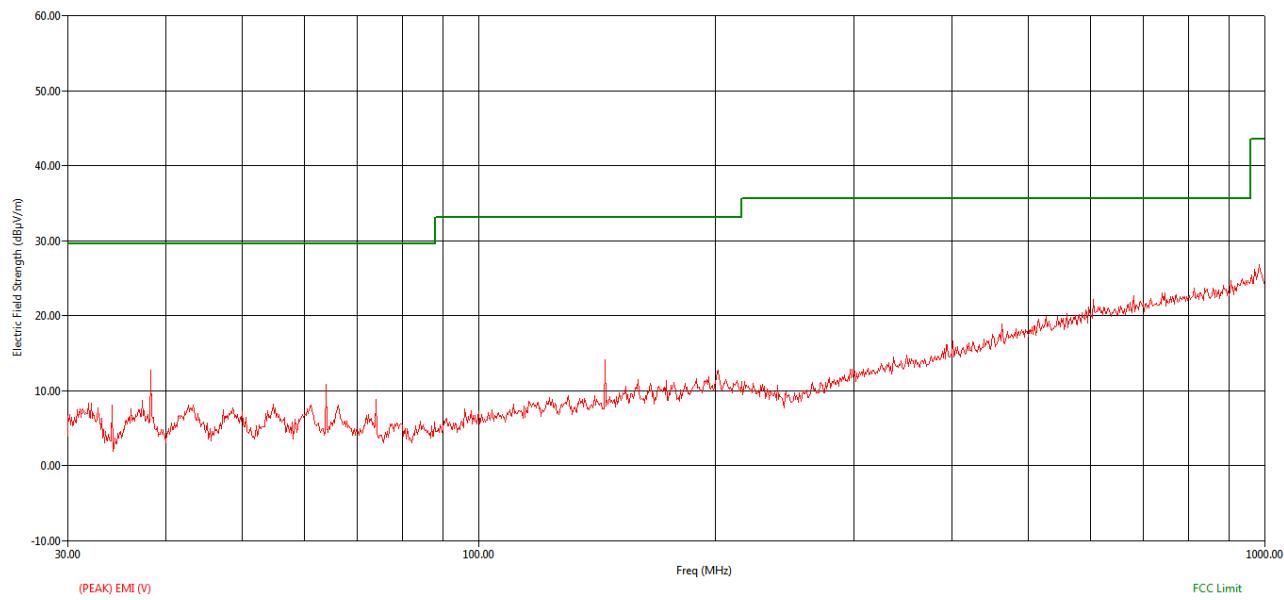
**Figure 21: RE graph from 9 kHz to 30 MHz using peak detector – Perpendicular**

Freq (MHz)	Freq (Max) (MHz)	Pol	EUT Ttbl Agl (deg)	(QP) Trace (dBμV)	Cable (dB)	Transducer (dB)	(QP) EMI (dBμV/m)	Limit (dBμV/m)	(QP) Margin (dB)
0.01	0.01	V	136.90	42.06	0.15	28.73	70.94	126.89	-55.95
0.45	0.45	V	288.30	35.87	0.21	17.50	53.58	94.48	-40.90

**Table 10: Quasi Peak table for RE from 9 kHz to 30 MHz - Perpendicular**



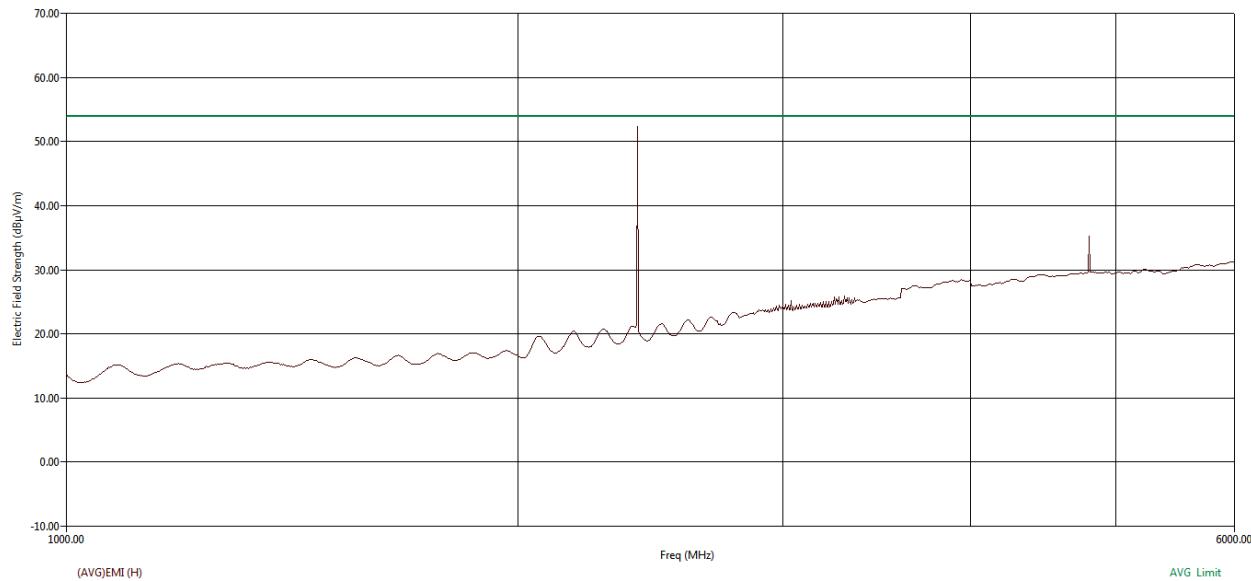
**Figure 22: RE graph from 30 MHz to 1 GHz using peak detector - Horizontal polarization**



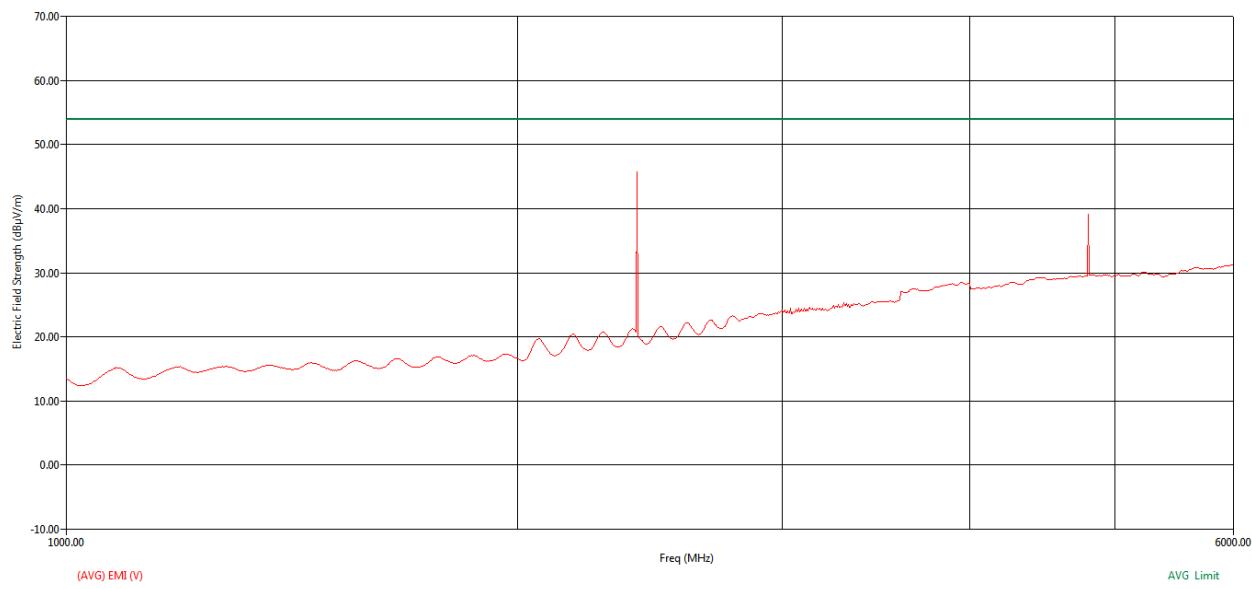
**Figure 23: RE graph from 30 MHz to 1 GHz using peak detector - Vertical polarization**

Freq (MHz)	Freq (Max) (MHz)	Pol	EUT Ttbl Agl (deg)	Twr Ht (cm)	(QP) Trace (dB $\mu$ V)	Cable (dB)	Preamp (dB)	Transducer (dB)	(QP) EMI (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	(QP) Margin (dB)
34.24	34.33	H	41.10	101.00	19.28	1.20	32.20	9.94	-1.78	29.54	-31.32
34.24	34.06	V	136.10	183.00	19.59	1.19	32.20	9.96	-1.47	29.54	-31.01
38.24	38.20	H	257.20	286.00	22.21	1.28	32.20	10.43	1.72	29.54	-27.82
38.24	38.28	V	10.30	149.00	22.04	1.28	32.20	10.44	1.56	29.54	-27.98
64.00	63.88	H	240.90	362.00	20.55	1.62	32.16	9.48	-0.51	29.54	-30.05
64.00	64.00	V	159.80	315.00	20.78	1.62	32.16	9.47	-0.30	29.54	-29.84
74.00	73.98	H	167.50	100.00	22.17	1.74	32.14	8.58	0.35	29.54	-29.19
74.00	73.97	V	81.30	285.00	22.30	1.74	32.14	8.58	0.48	29.54	-29.06
144.92	144.82	H	61.60	191.00	21.75	2.37	32.05	10.97	3.03	33.06	-30.03
144.92	144.94	V	83.00	144.00	21.70	2.37	32.05	10.97	3.00	33.06	-30.06

**Table 11: Quasi Peak table for RE from 30 MHz to 1 GHz**



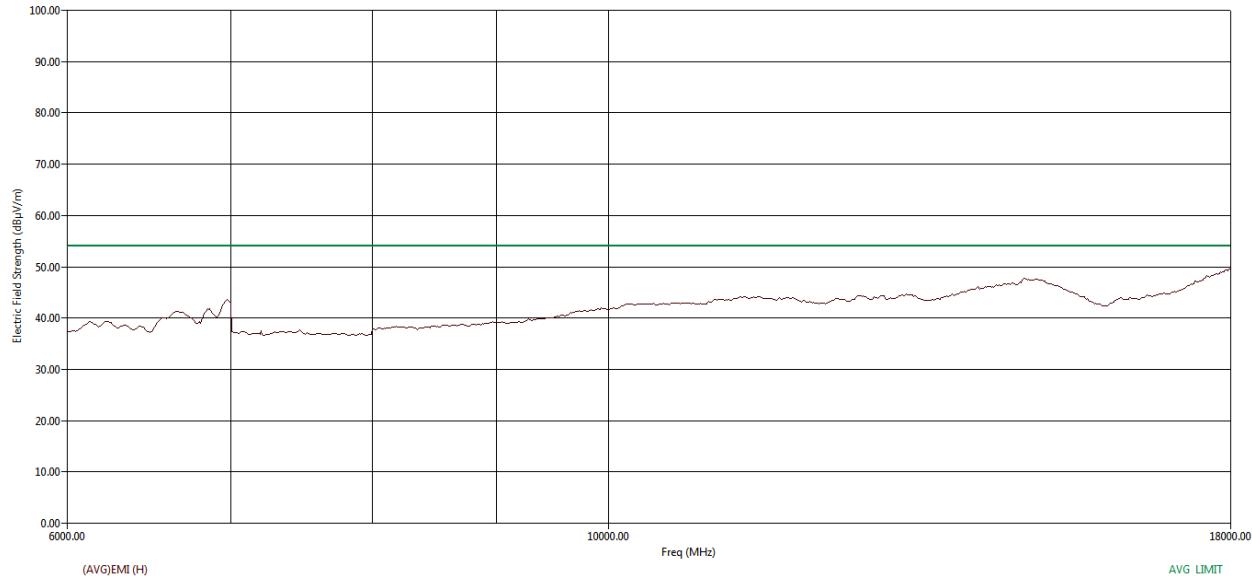
**Figure 24: RE graph from 1 GHz to 6 GHz using average detector - Horizontal polarization**



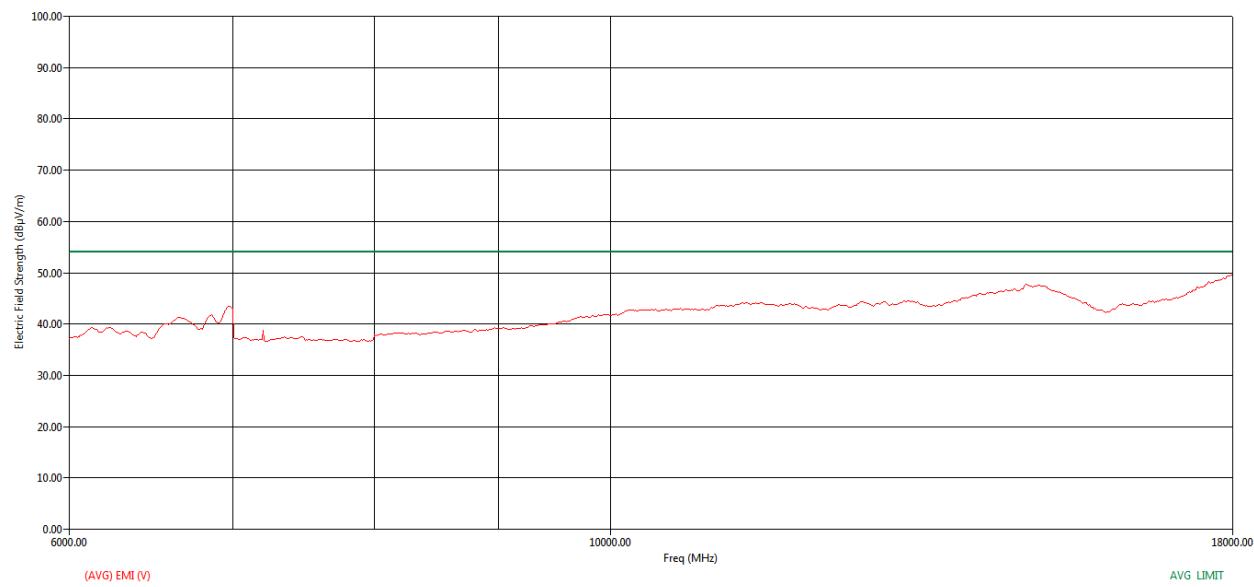
**Figure 25: RE graph from 1 GHz to 6 GHz using average detector - Vertical polarization**

Freq (MHz)	Freq (MHz) (Max)	Twr Ht (cm)	Pol	EUT Ttbl Agl (deg)	(AVG) Trace (dB $\mu$ V)	Transducer (dB)	Preamp (dB)	Cable (dB)	(AVG) EMI (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	(AVG) Margin (dB)
2401.6	2401.22	100	V	42	55.16	24.3	31.44	2.6	50.62	53.98	-3.36
4802.4	4802.4	100	H	141.6	37.2	28.47	28.66	3.66	40.66	53.98	-13.32
4802.4	4853.19	111	V	194.1	25.86	28.45	28.57	3.69	29.44	53.98	-24.54

**Table 12: Average Table for RE from 1 GHz to 6 GHz**



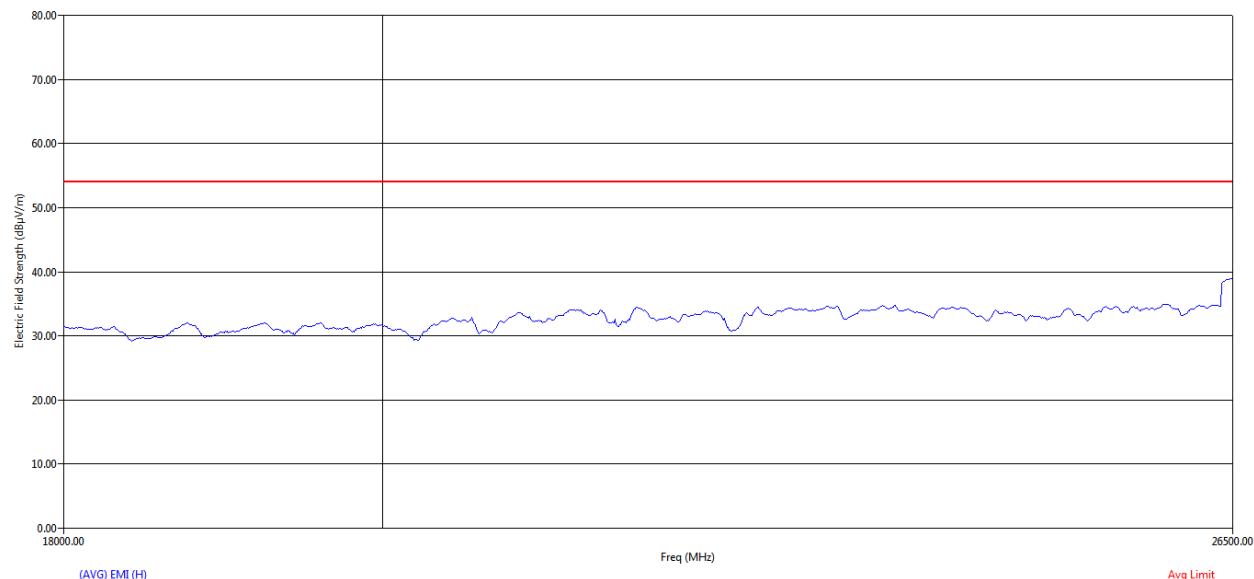
**Figure 26: RE graph from 6 GHz to 18 GHz using Average Detector - Horizontal polarization**



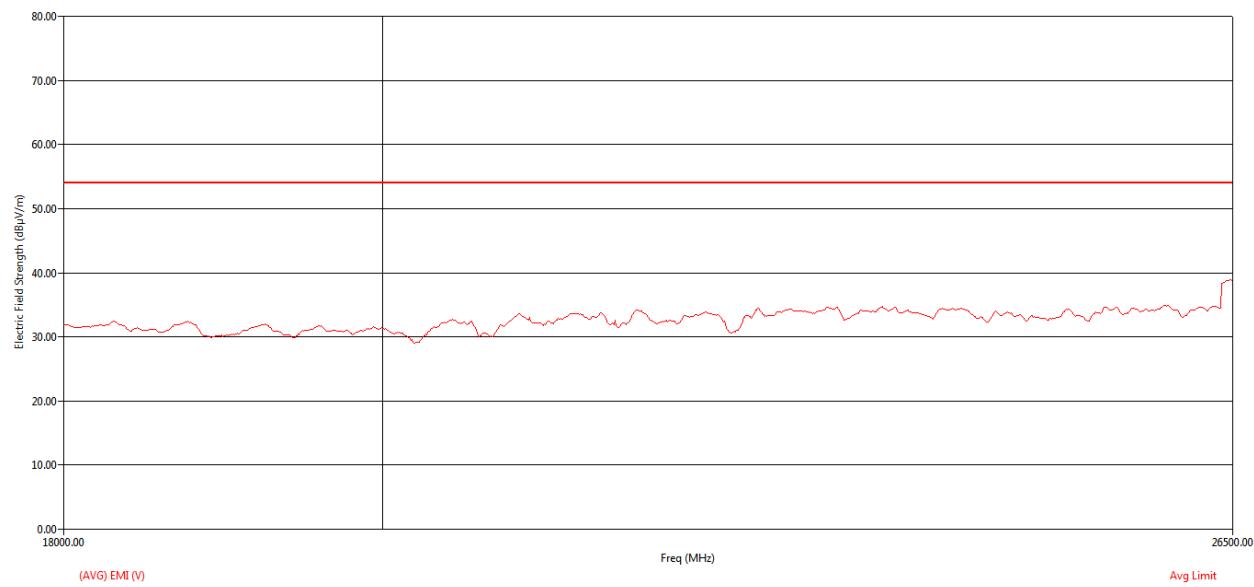
**Figure 27: RE graph from 6 GHz to 18 GHz using Average Detector - Vertical polarization**

Freq (MHz)	Freq (Max) (MHz)	Pol	EUT Ttbl Agl (deg)	Twr Ht (cm)	(AVG) Trace (dBμV)	Cable (dB)	Transducer (dB)	Preamp (dB)	(AVG) EMI (dBμV/m)	Limit (dBμV/m)	(AVG) Margin (dB)
6974.40	6983.48	H	188.20	200.00	34.83	4.21	32.54	28.30	43.28	53.98	-10.70
6985.60	6998.90	V	72.50	200.00	34.49	4.21	32.59	28.30	42.98	53.98	-11.00
14643.60	14847.55	V	239.10	100.00	29.85	6.60	39.13	28.20	47.38	53.98	-6.60
14957.20	15072.60	H	211.30	100.00	29.64	6.68	39.01	28.23	47.11	53.98	-6.87

**Table 13: Average Table for RE from 6 GHz to 18 GHz**

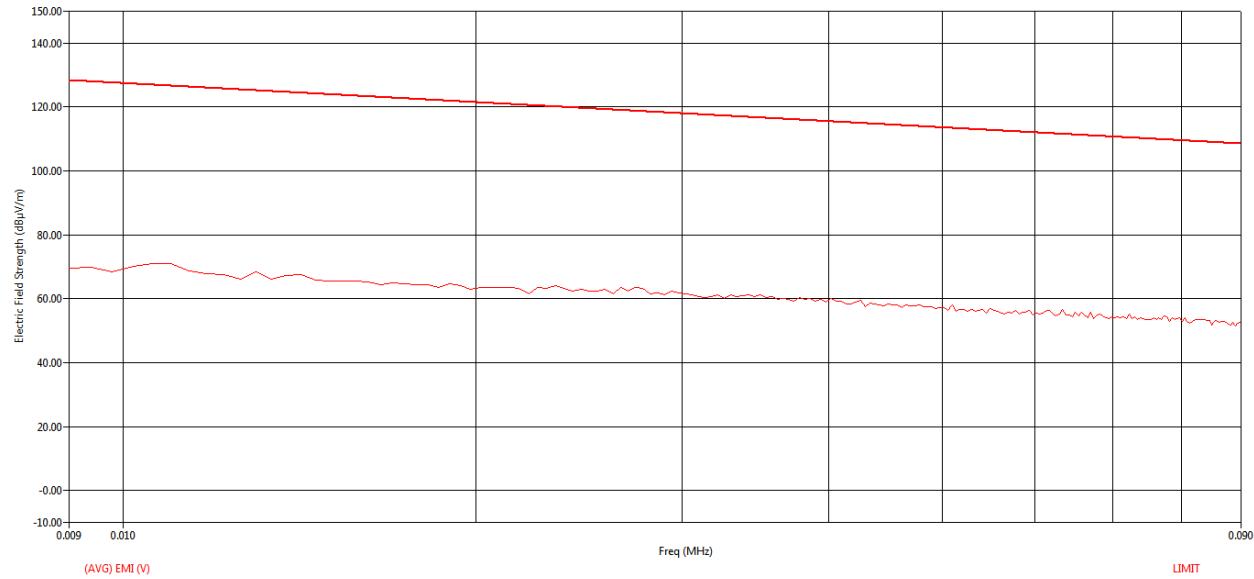


**Figure 28: RE graph from 18 GHz to 26.5 GHz using Average Detector - Horizontal polarization**



**Figure 29: RE graph from 18 GHz to 26.5 GHz using Average Detector - Vertical polarization**

### MID CHANNEL CONTINUOUS TX



**Figure 30: RE graph from 9 kHz to 90 kHz using Average Detector – Parallel**

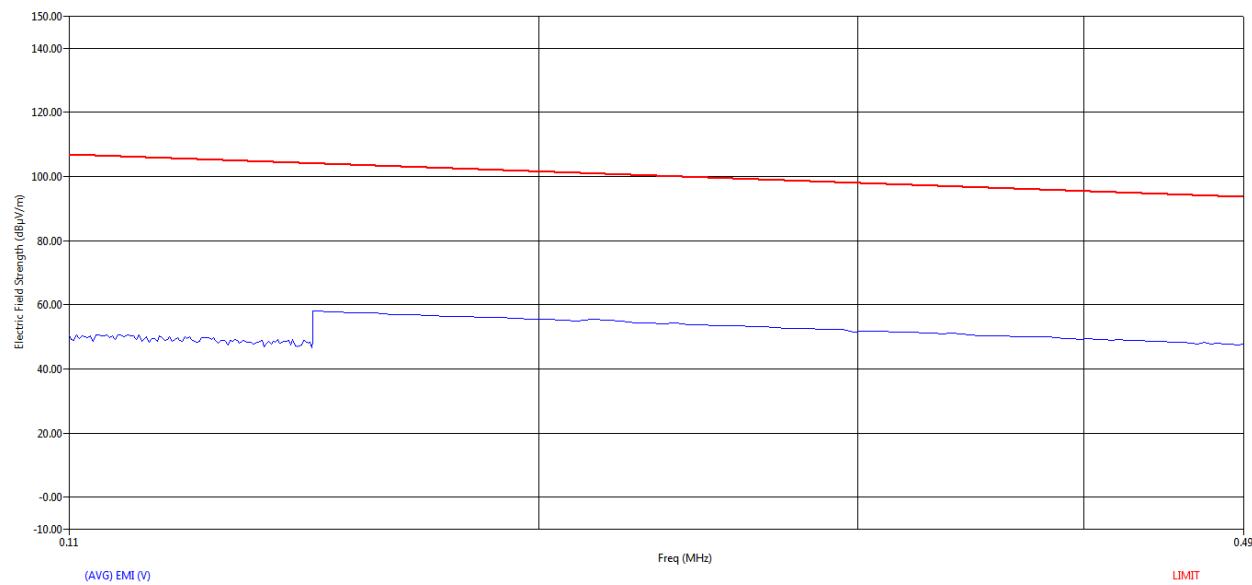


Figure 31: RE graph from 110 kHz to 490 kHz using Average Detector - Parallel

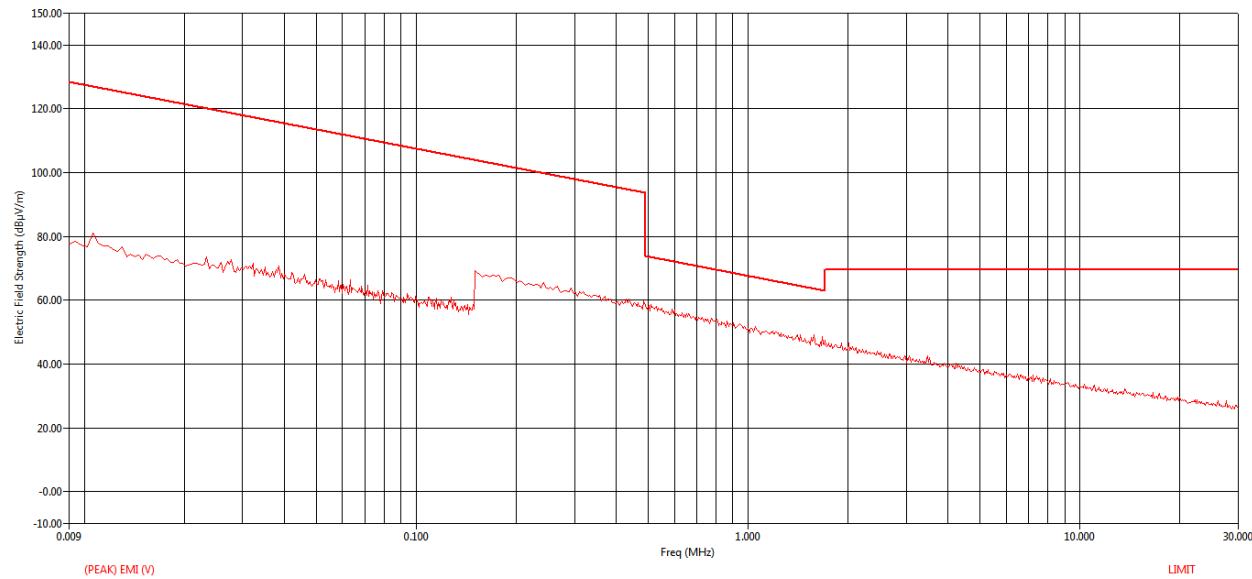
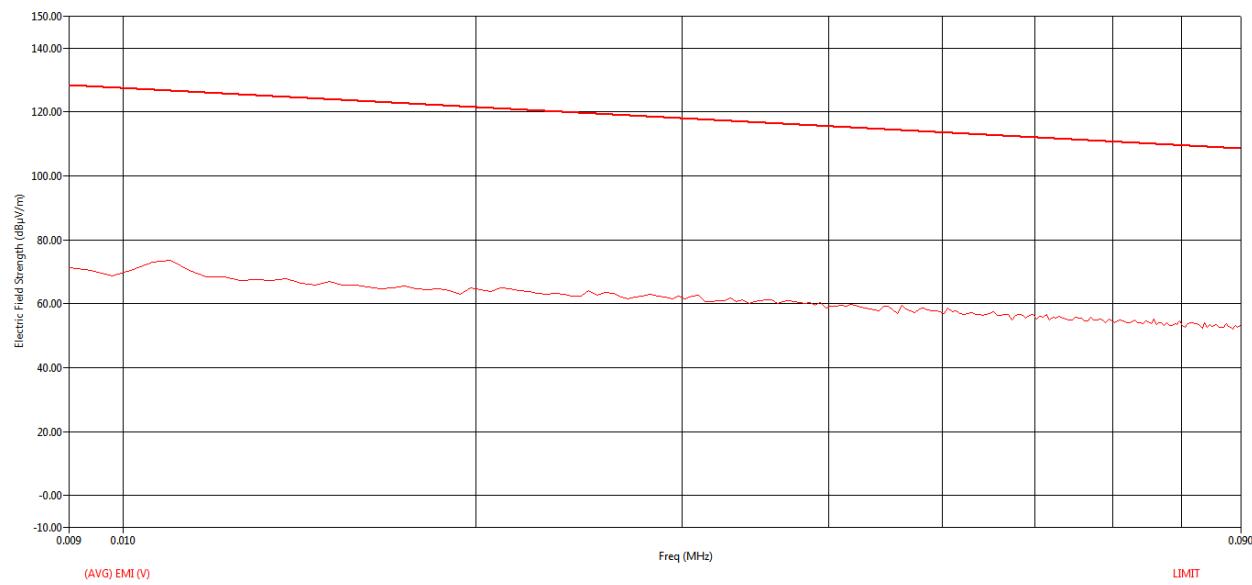


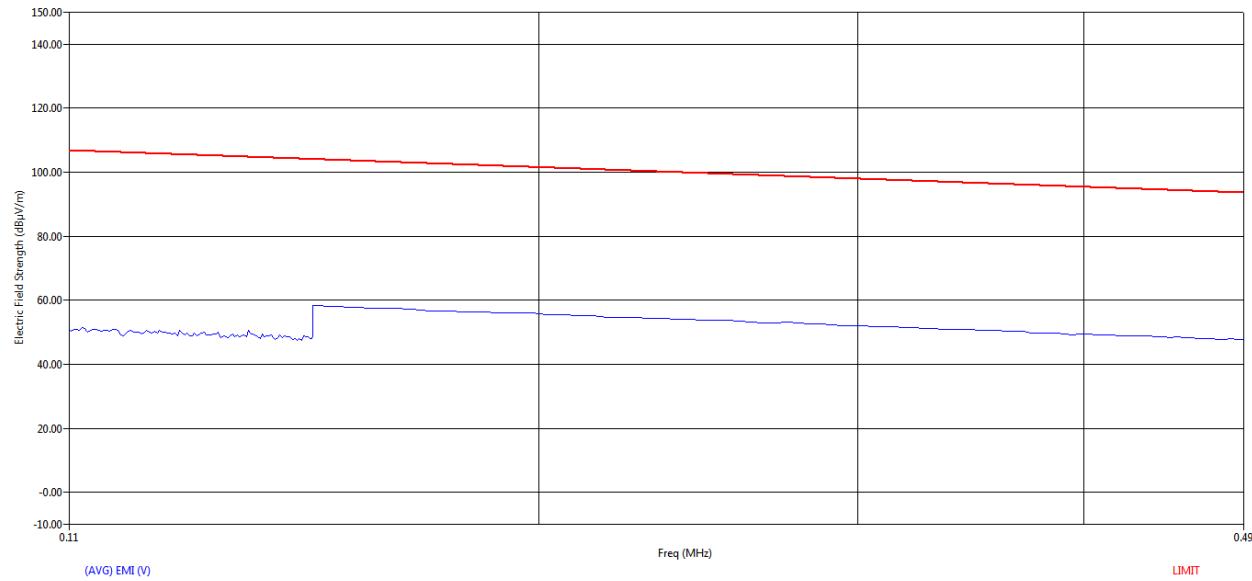
Figure 32: RE graph from 9 kHz to 30 MHz using Peak Detector – Parallel

Freq (MHz)	Freq (Max) (MHz)	Pol	EUT Ttbl Agl (deg)	(QP) Trace (dB $\mu$ V)	Cable (dB)	Transducer (dB)	(QP) EMI (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	(QP) Margin (dB)
0.01	0.01	V	136.90	42.06	0.15	28.73	70.94	126.89	-55.95
0.45	0.45	V	288.30	35.87	0.21	17.50	53.58	94.48	-40.90

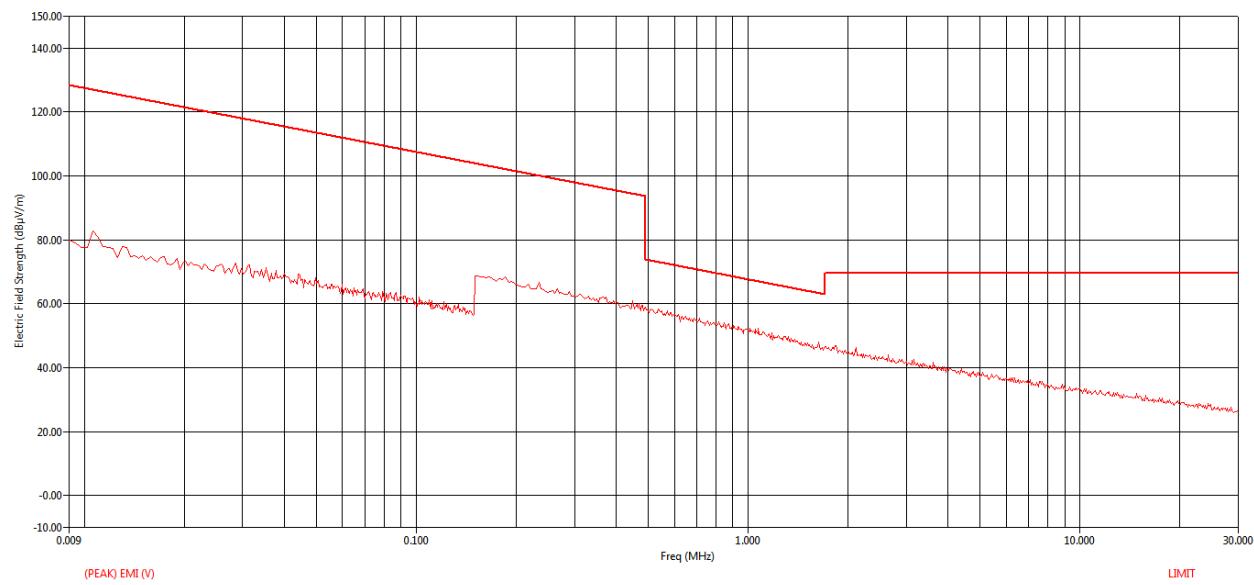
Table 14: Quasi Peak table for RE from 9 kHz to 30 MHz - Parallel



**Figure 33: RE graph from 9 kHz to 90 kHz using Average Detector – Perpendicular**



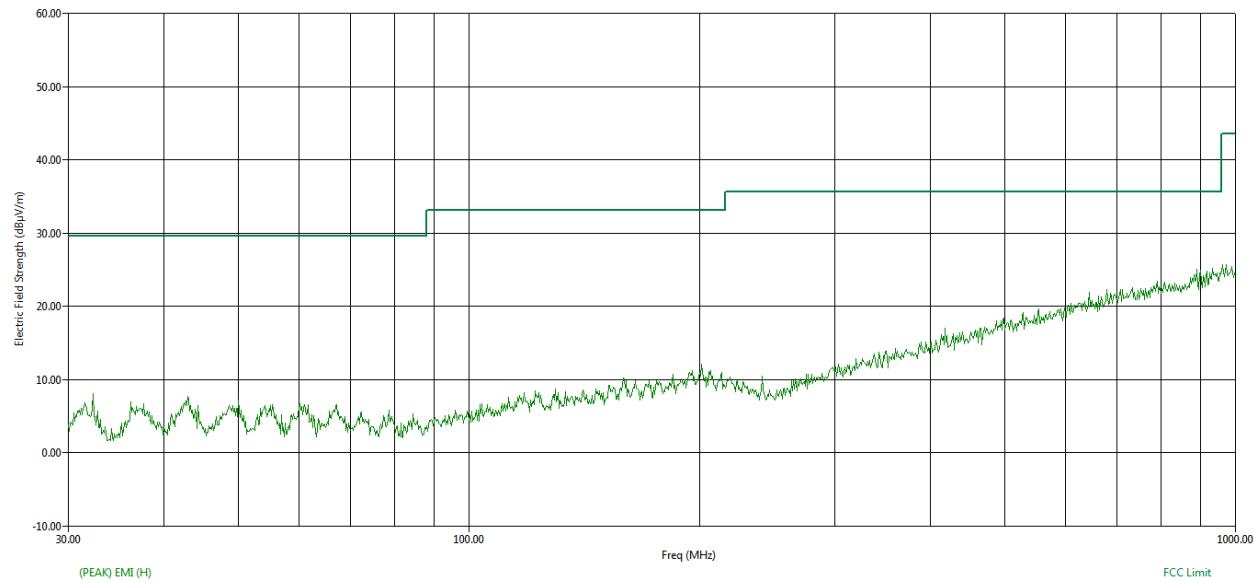
**Figure 34: RE graph from 110 kHz to 490 kHz using Average Detector - Perpendicular**



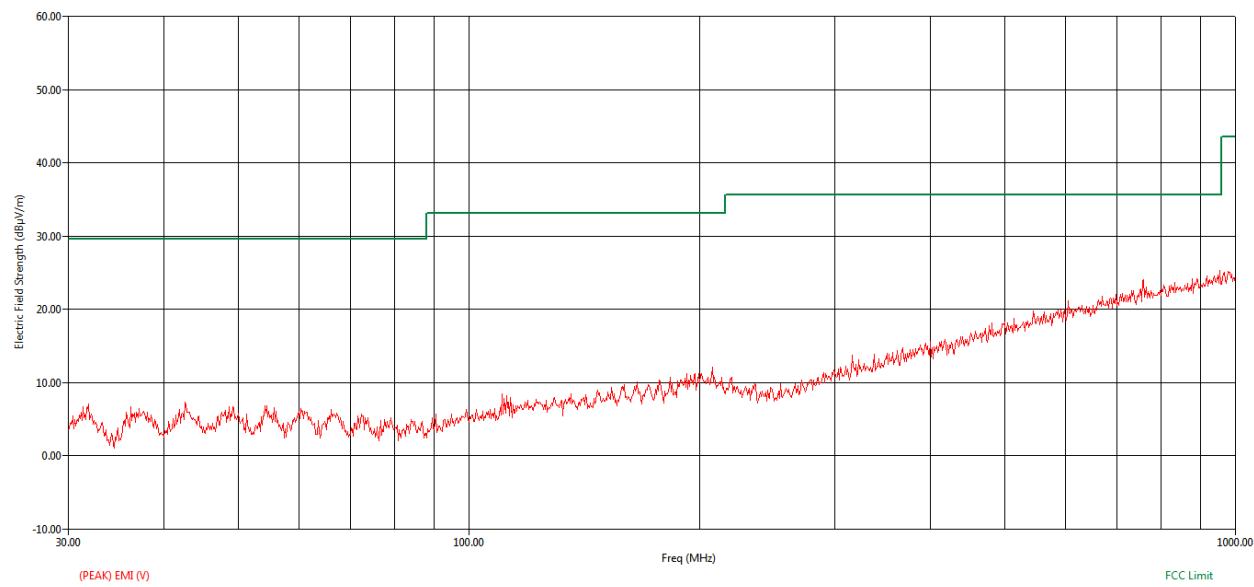
**Figure 35: RE graph from 9 kHz to 30 MHz using Peak Detector – Perpendicular**

Freq (MHz)	Freq (Max) (MHz)	Pol	EUT Ttbl Agl (deg)	(QP) Trace (dB $\mu$ V)	Cable (dB)	Transducer (dB)	(QP) EMI (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	(QP) Margin (dB)
0.01	0.01	V	136.90	42.06	0.15	28.73	70.94	126.89	-55.95
0.45	0.45	V	288.30	35.87	0.21	17.50	53.58	94.48	-40.90

**Table 15: Quasi Peak table for RE from 9 kHz to 30 MHz – Perpendicular**



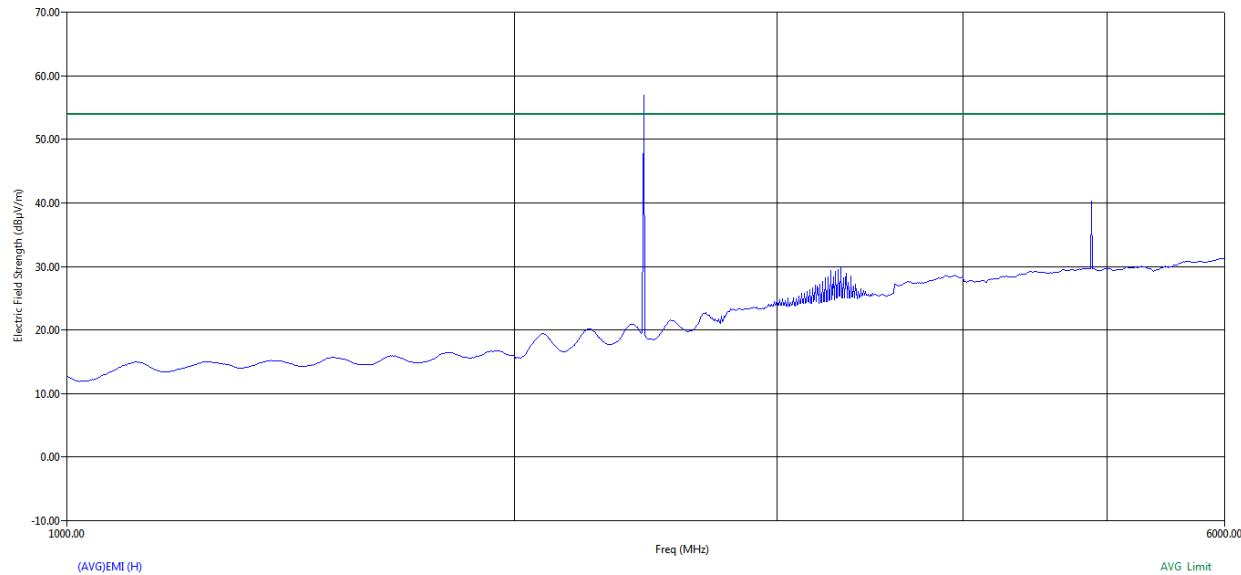
**Figure 36: RE graph from 30 MHz to 1 GHz using Peak Detector - Horizontal polarization**



**Figure 37: RE graph from 30 MHz to 1 GHz using Peak Detector - Vertical polarization**

Freq (MHz)	Freq (Max) (MHz)	Pol	EUT Ttbl Agl (deg)	Twr Ht (cm)	(QP) Trace (dBμV)	Transducer (dB)	Cable (dB)	Preamp (dB)	(QP) EMI (dBμV/m)	FCC Limit (dBμV/m)	FCC Margin (dB)
32.28	32.28	H	32.40	267.00	22.64	10.09	1.16	32.53	1.37	39.08	-37.71
36.20	36.23	H	146.40	255.00	22.56	10.10	1.23	32.52	1.37	39.08	-37.71
207.70	207.74	H	168.30	297.00	22.40	12.75	2.86	32.10	5.91	43.52	-37.61
759.25	759.32	V	79.60	400.00	22.66	20.90	5.32	31.64	17.24	46.44	-29.20

**Table 16: Quasi Peak Table for RE from 30 MHz to 1 GHz**



**Figure 38: RE graph from 1 GHz to 6 GHz using Average Detector - Horizontal polarization**

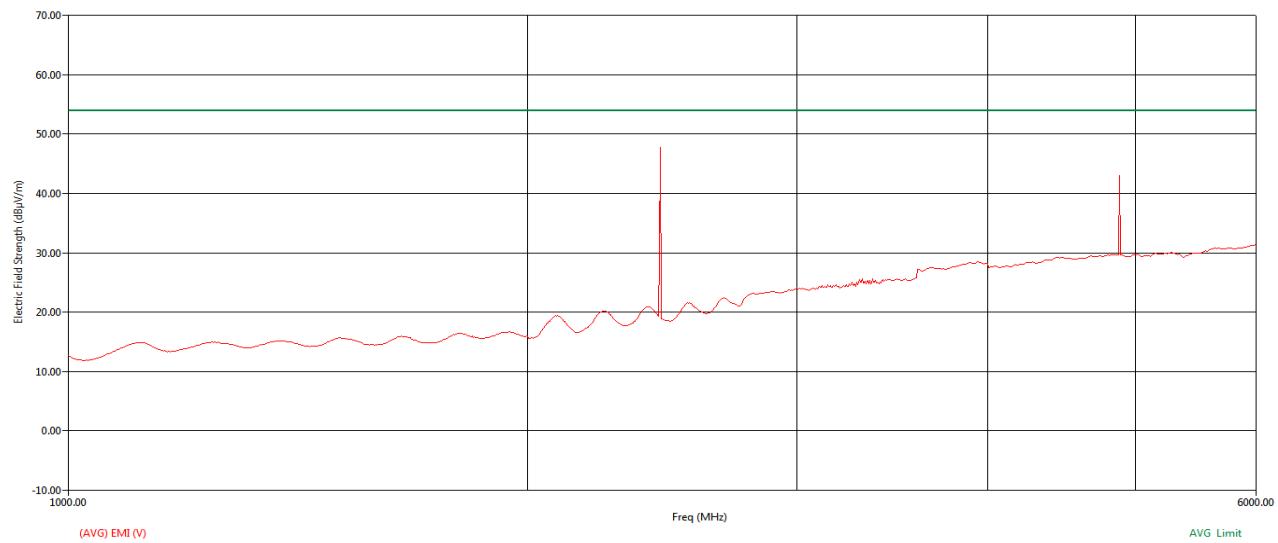


Figure 39: RE graph from 1 GHz to 6 GHz using Average Detector - Vertical polarization

Freq (MHz)	Freq (Max) (MHz)	Pol	Test Ht. (cm)	EL/T Tbl Agl (deg)	(AVG) Trace (dB $\mu$ V)	Transducer (dB)	Preamp (dB)	Cable (dB)	(AVG) EMI (dB $\mu$ V/m)	Avg Limit (dB $\mu$ V/m)	(AVG) Margin (dB)
2180.90	2094.92	H	200.00	85.60	25.58	23.25	32.08	2.43	19.18	53.98	-34.80
2441.60	2441.60	V	100.00	275.50	52.95	24.43	31.37	2.62	48.63	53.98	-5.35
4883.20	4883.20	H	100.00	168.80	40.54	28.45	28.51	3.70	44.18	53.98	-9.80
4883.60	4883.60	V	111.00	163.20	42.44	28.45	28.51	3.71	46.08	53.98	-7.90

Table 17: Average Table for RE from 1 GHz to 6 GHz

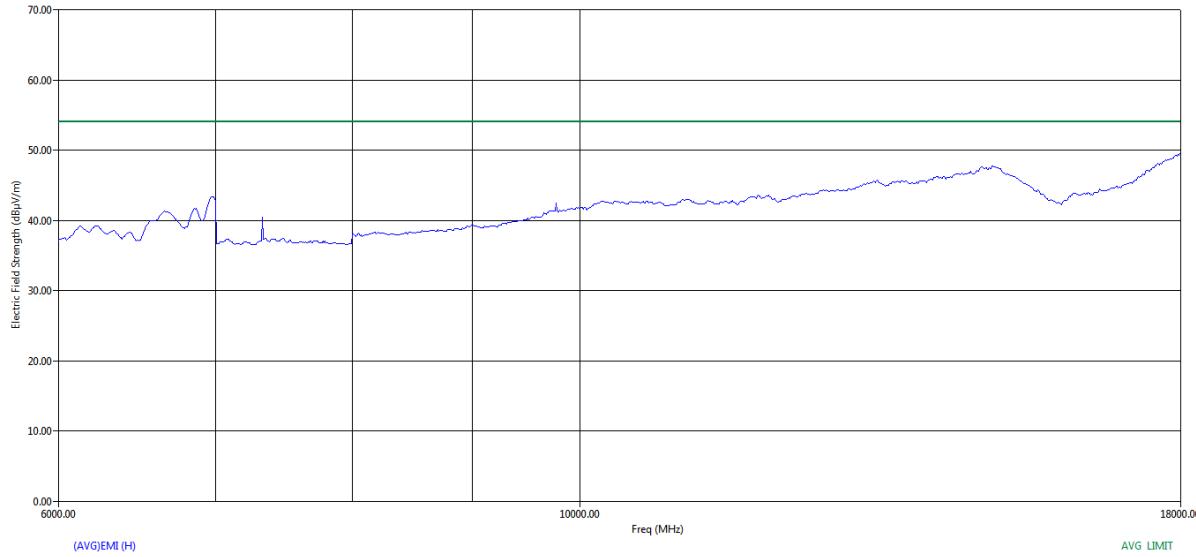
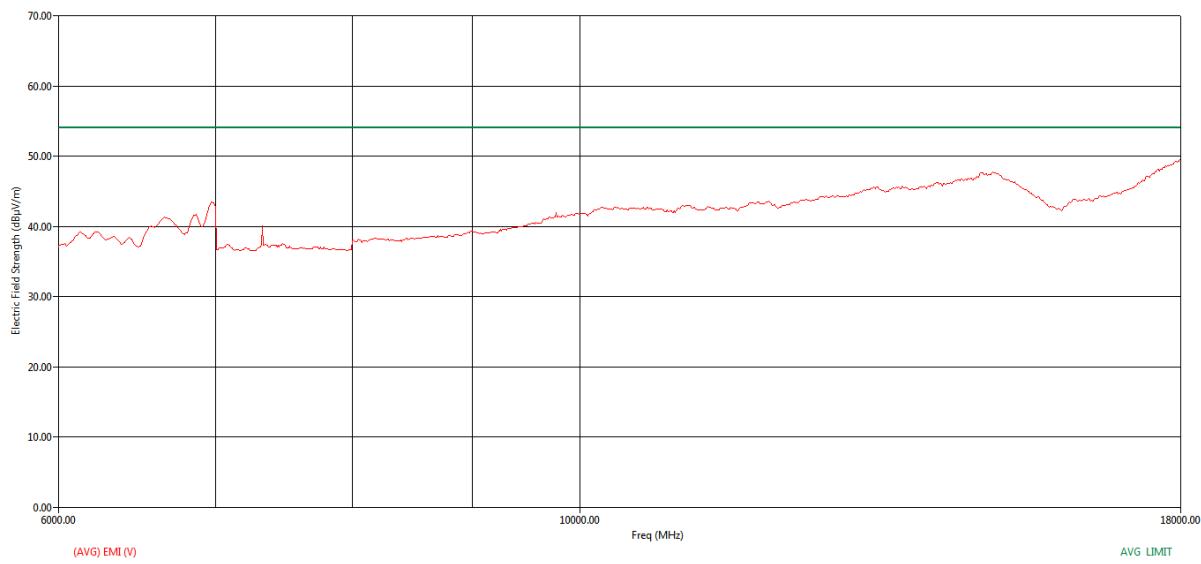


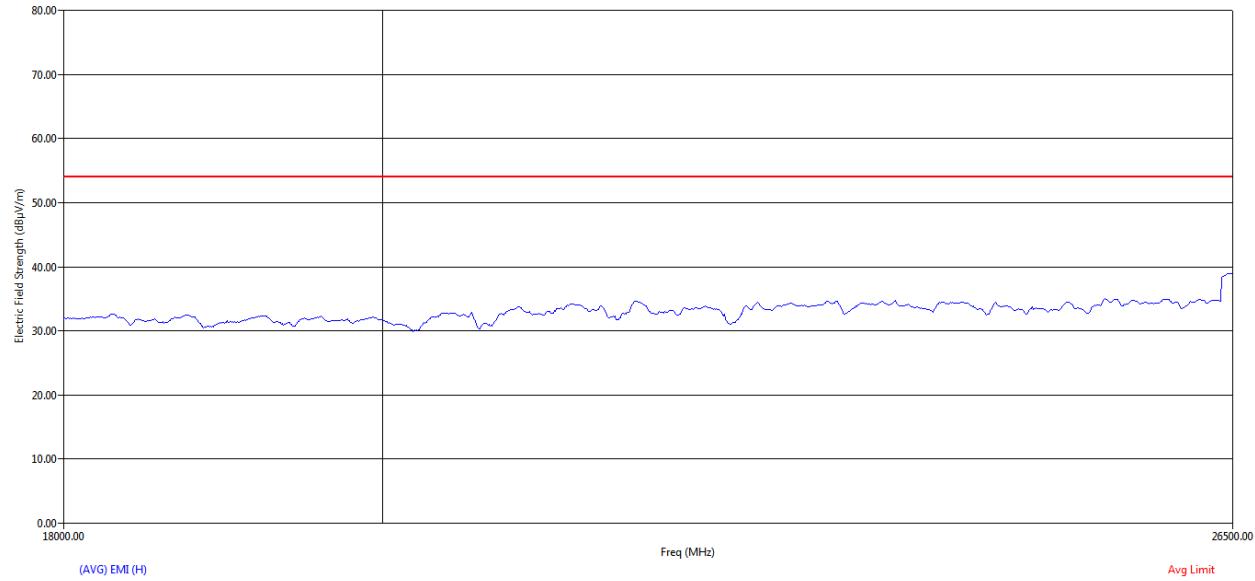
Figure 40: RE graph from 6 GHz to 18 GHz using Average Detector - Horizontal polarization



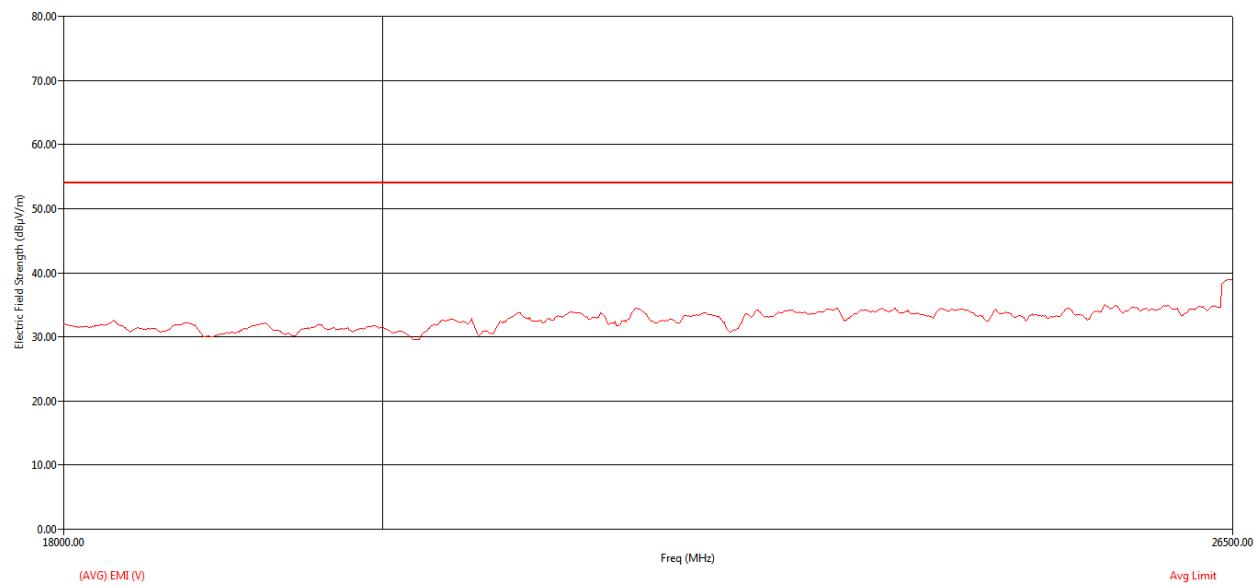
**Figure 41: RE graph from 6 GHz to 18 GHz using Average Detector - Vertical polarization**

Freq (MHz)	Freq (Max) (MHz)	Pol	Twr Ht (cm)	EUT Ttbl Agl (deg)	(AVG) Trace (dB $\mu$ V)	Cable (dB)	Transducer (dB)	Preamp (dB)	(AVG) EMI (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	(AVG) Margin (dB)
6978.00	6992.68	V	100.00	232.20	34.38	4.21	32.57	28.30	42.86	53.98	-11.12
6980.00	6717.73	H	100.00	233.10	32.77	4.16	31.80	28.33	40.40	53.98	-13.58
7324.80	7434.16	H	200.00	233.90	28.52	4.38	32.96	28.80	37.06	53.98	-16.92
7324.80	7373.97	V	200.00	130.90	28.34	4.35	32.91	28.73	36.88	53.98	-17.10
9766.40	9959.18	H	100.00	190.80	28.34	5.09	36.42	28.10	41.75	53.98	-12.23
9766.40	10170.56	V	100.00	353.80	28.55	5.13	36.74	28.12	42.30	53.98	-11.68

**Figure 42: Average Table for RE from 6GHz to 18 GHz**

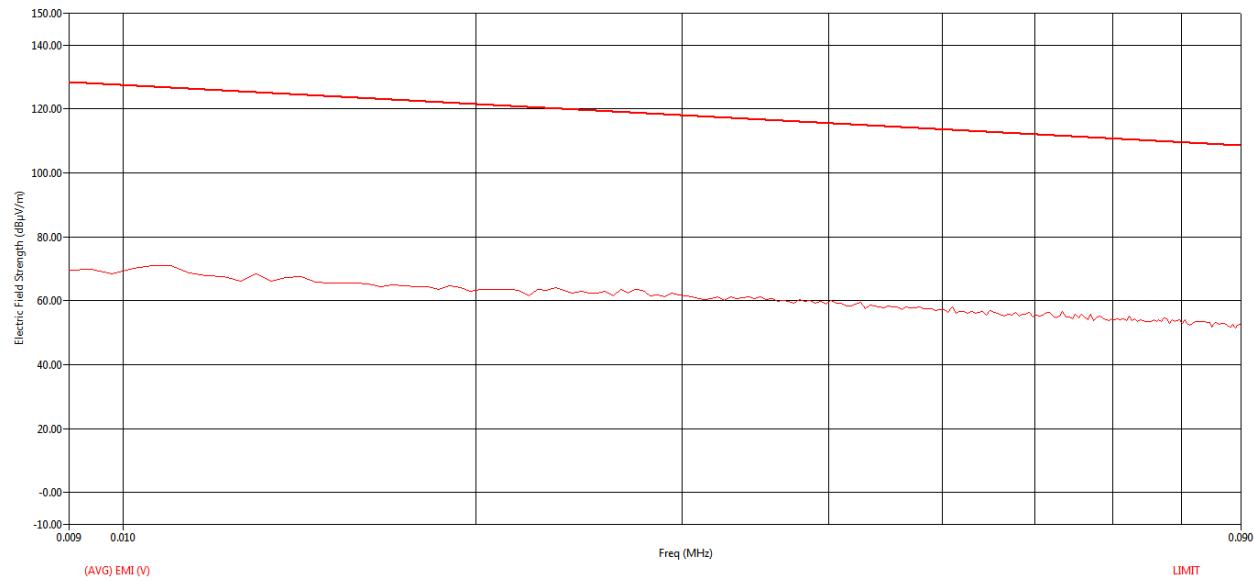


**Figure 43: RE graph from 18 GHz to 26.5 GHz using Average Detector - Horizontal polarization**

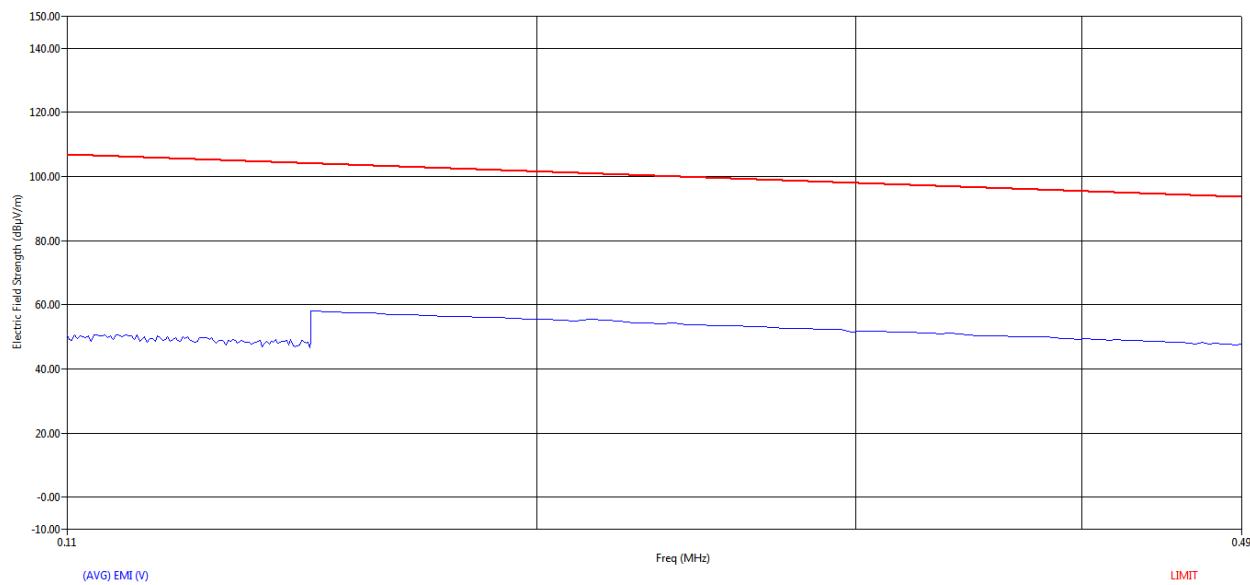


**Figure 44: RE graph from 18 GHz to 26.5 GHz using Average Detector - Vertical polarization**

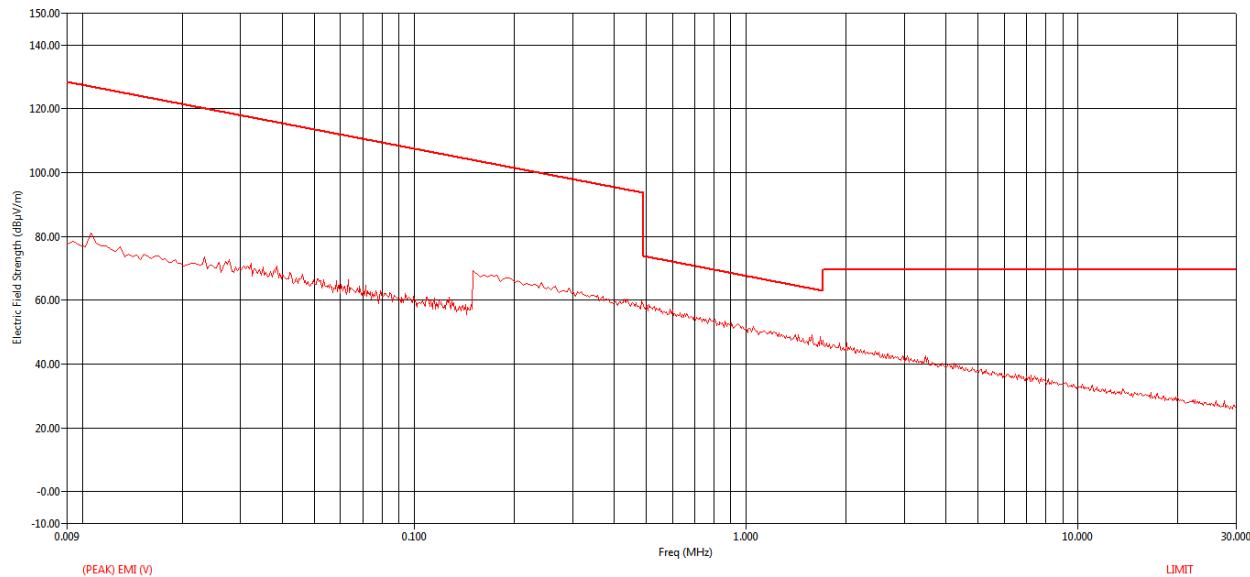
## HIGH CHANNEL CONTINUOUS TX



**Figure 45: RE graph from 9 kHz to 90 kHz using Average Detector – Parallel**



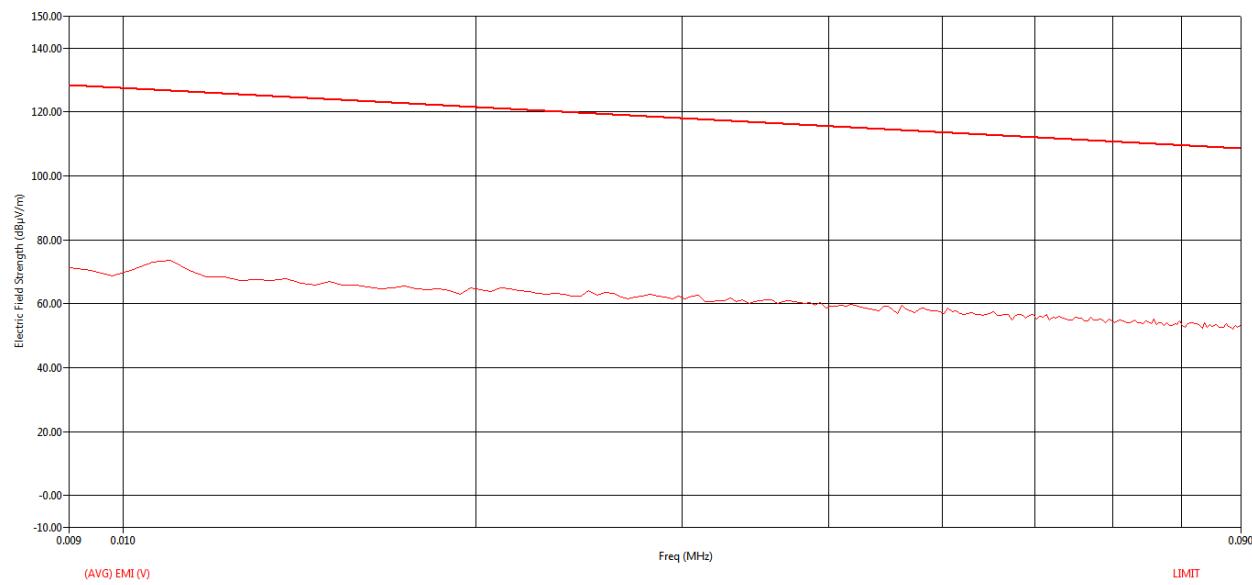
**Figure 46: RE graph from 110 kHz to 490 kHz using Average Detector - Parallel**



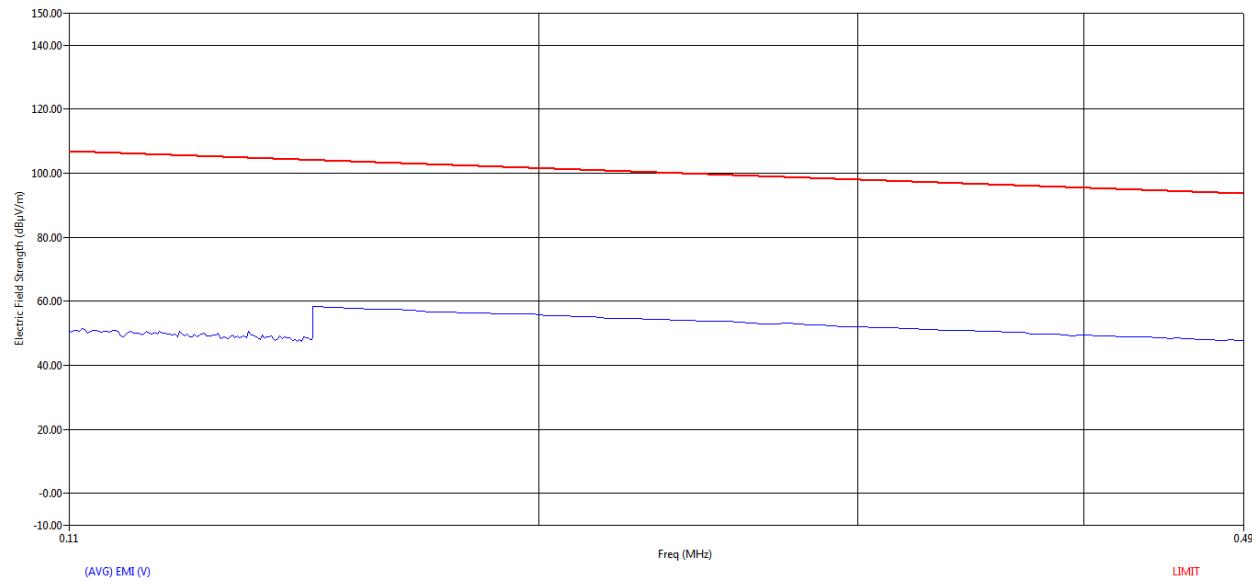
**Figure 47: RE graph from 9 kHz to 30 MHz using Peak Detector – Parallel**

Freq (MHz)	Freq (Max) (MHz)	Pol	EUT Ttbl Agl (deg)	(QP) Trace (dB $\mu$ V)	Cable (dB)	Transducer (dB)	(QP) EMI (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	(QP) Margin (dB)
0.01	0.01	V	136.90	42.06	0.15	28.73	70.94	126.89	-55.95
0.45	0.45	V	288.30	35.87	0.21	17.50	53.58	94.48	-40.90

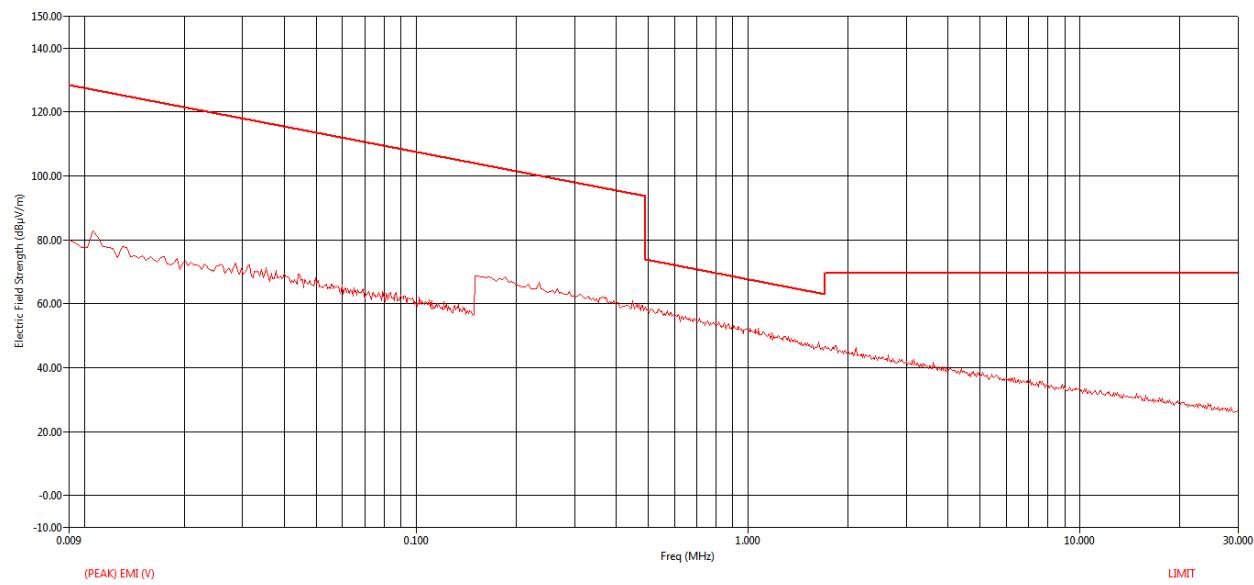
**Table 18: Quasi Peak table for RE from 9 kHz to 30 MHz - Parallel**



**Figure 48: RE graph from 9 kHz to 90 kHz using Average Detector – Perpendicular**



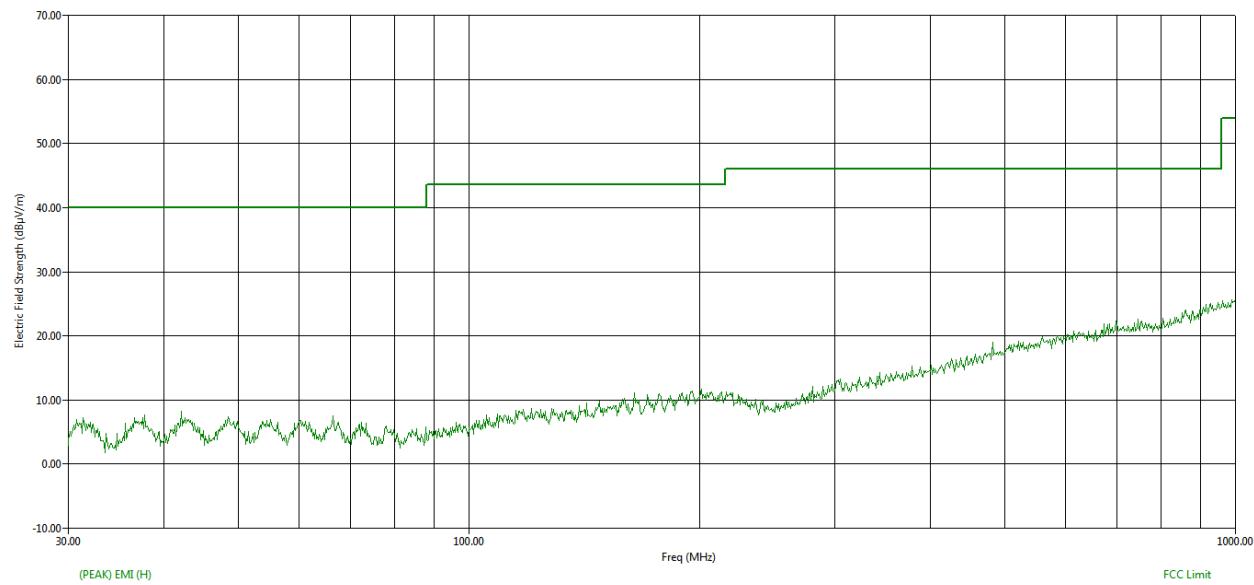
**Figure 49: RE graph from 110 kHz to 490 kHz using Average Detector - Perpendicular**



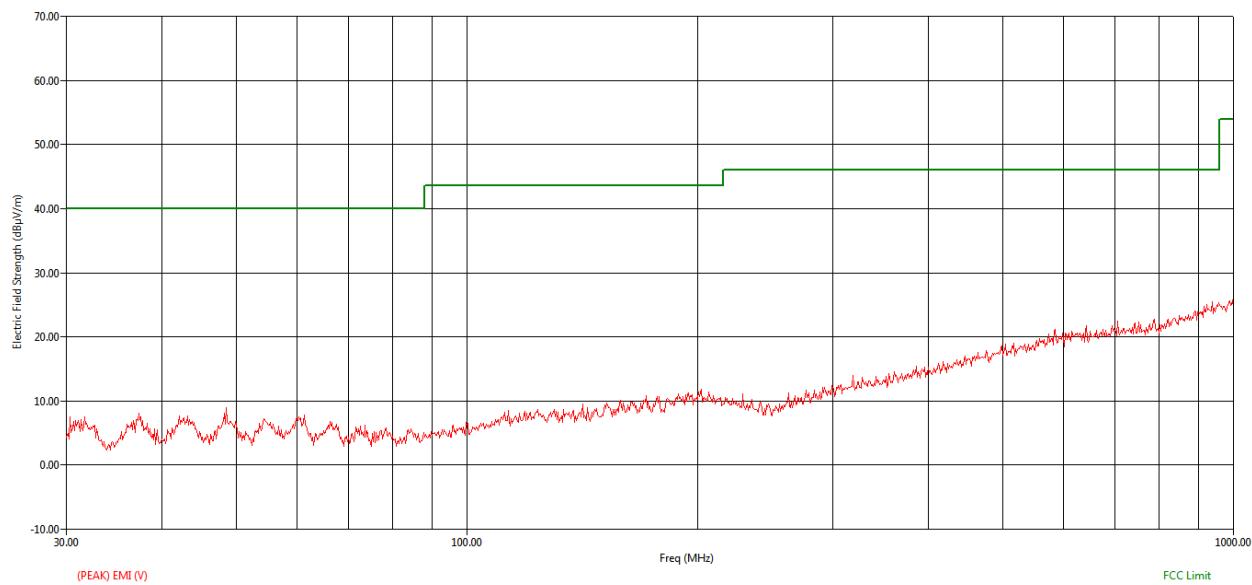
**Figure 50: RE graph from 9 kHz to 30 MHz using Peak Detector – Perpendicular**

Freq (MHz)	Freq (Max) (MHz)	Pol	EUT Ttbl Agl (deg)	(QP) Trace (dB $\mu$ V)	Cable (dB)	Transducer (dB)	(QP) EMI (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	(QP) Margin (dB)
0.01	0.01	V	136.90	42.06	0.15	28.73	70.94	126.89	-55.95
0.45	0.45	V	288.30	35.87	0.21	17.50	53.58	94.48	-40.90

**Table 19: Quasi Peak table for RE from 9 kHz to 30 MHz - Perpendicular**



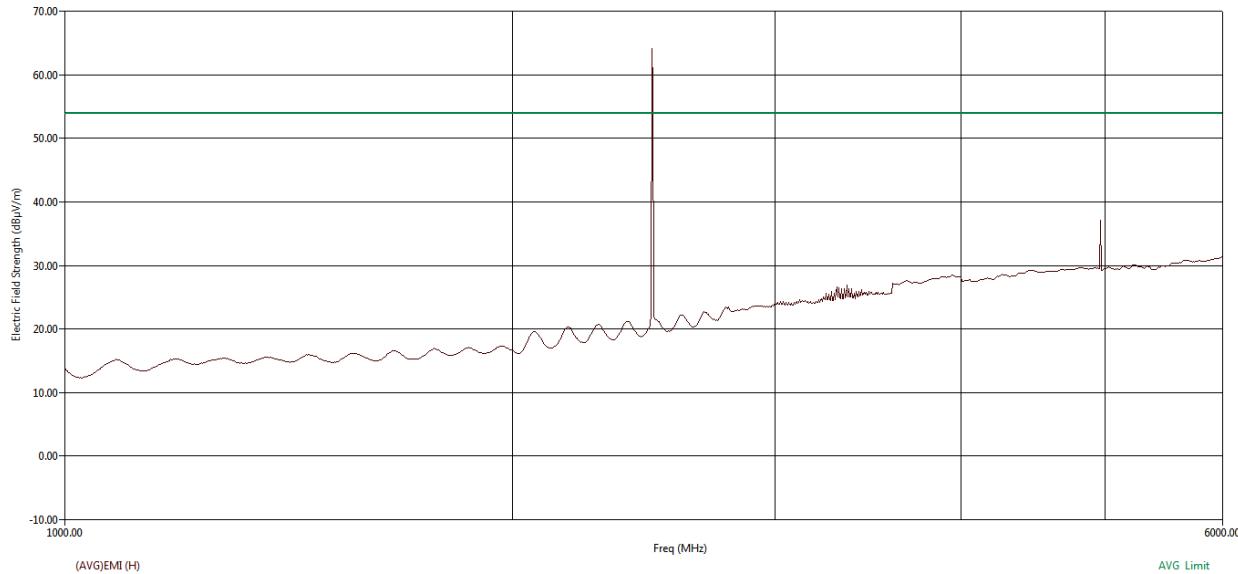
**Figure 51: RE graph from 30 MHz to 1 GHz using Peak Detector - Horizontal polarization**



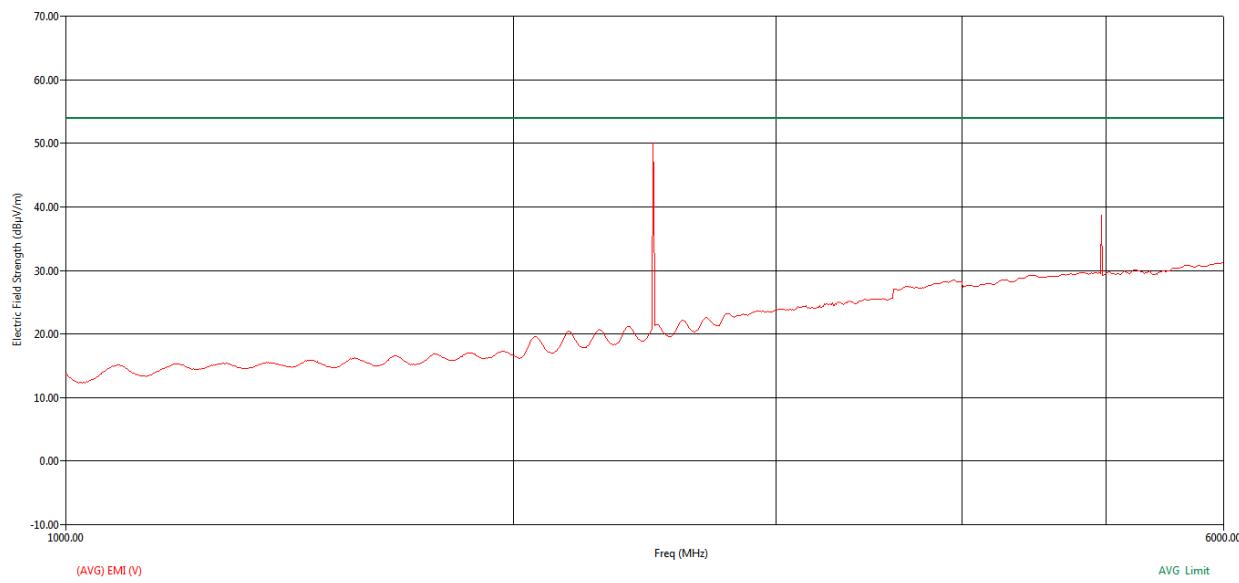
**Figure 52: RE graph from 30 MHz to 1 GHz using Peak Detector - Vertical polarization**

Freq (MHz)	Freq (Max) (MHz)	Pol	EUT Ttbl Agl (deg)	Twr Ht (cm)	(QP) Trace (dBμV)	Cable (dB)	Preamp (dB)	Transducer (dB)	(QP) EMI (dBμV/m)	FCC Limit (dBμV/m)	(QP) Margin FCC (dB)
48.48	48.44	V	179.70	145.00	23.14	141	32.20	10.09	2.44	40.00	-37.56

**Table 20: Quasi Peak Table for RE from 30 MHz to 1 GHz**



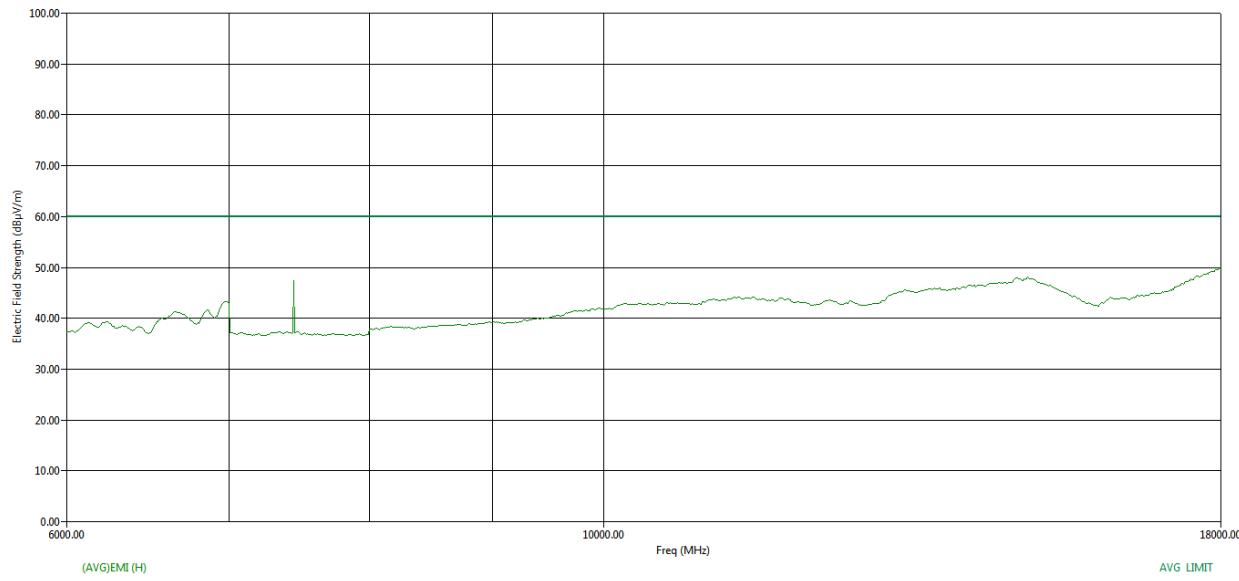
**Figure 53: RE graph from 1 GHz to 6 GHz using Average Detector - Horizontal polarization**



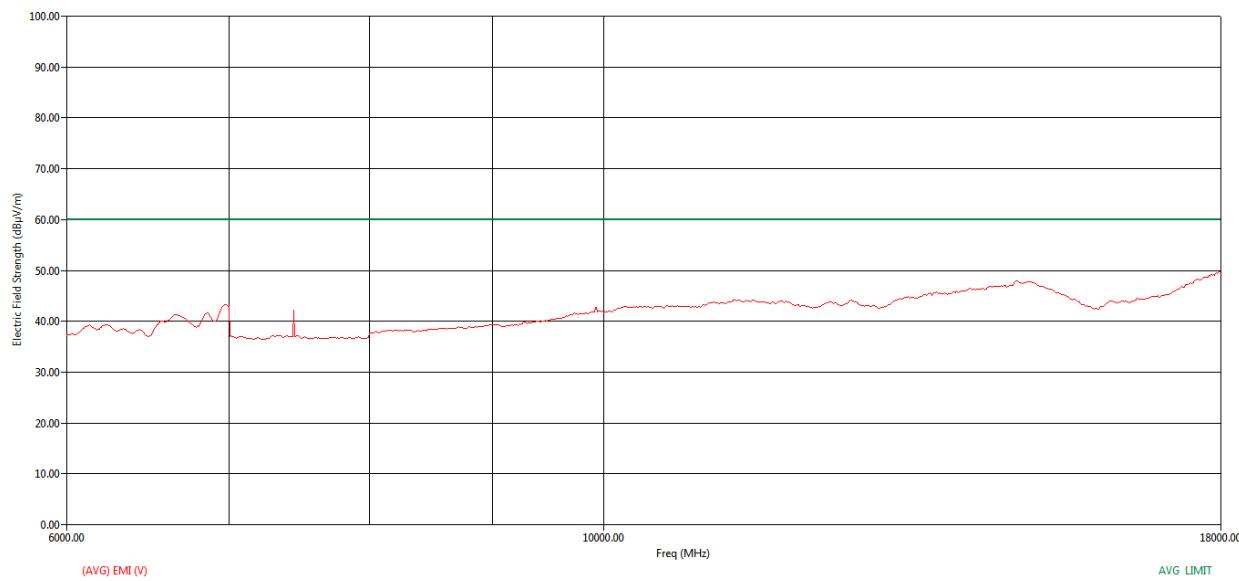
**Figure 54: RE graph from 1 GHz to 6 GHz using Average Detector - Vertical polarization**

Freq (MHz)	Freq (Max) (MHz)	Twr Ht (cm)	Pol	EUT Ttbl Agl (deg)	(AVG) Trace (dBμV)	Transducer (dB)	Preamp (dB)	Cable (dB)	(AVG) EMI (dBμV/m)	Avg Limit (dBμV/m)	(AVG) Margin (dB)
4964.80	4964.80	100.00	H	122.90	35.60	28.43	28.36	3.75	39.41	53.98	-14.57
4964.80	4964.80	100.00	V	262.50	33.98	28.43	28.36	3.75	37.79	53.98	-16.19
5800.00	5639.57	100.00	H	246.60	25.72	29.21	28.37	3.89	30.46	53.98	-23.52

**Table 21: Average Table for RE from 1 GHz to 6 GHz**



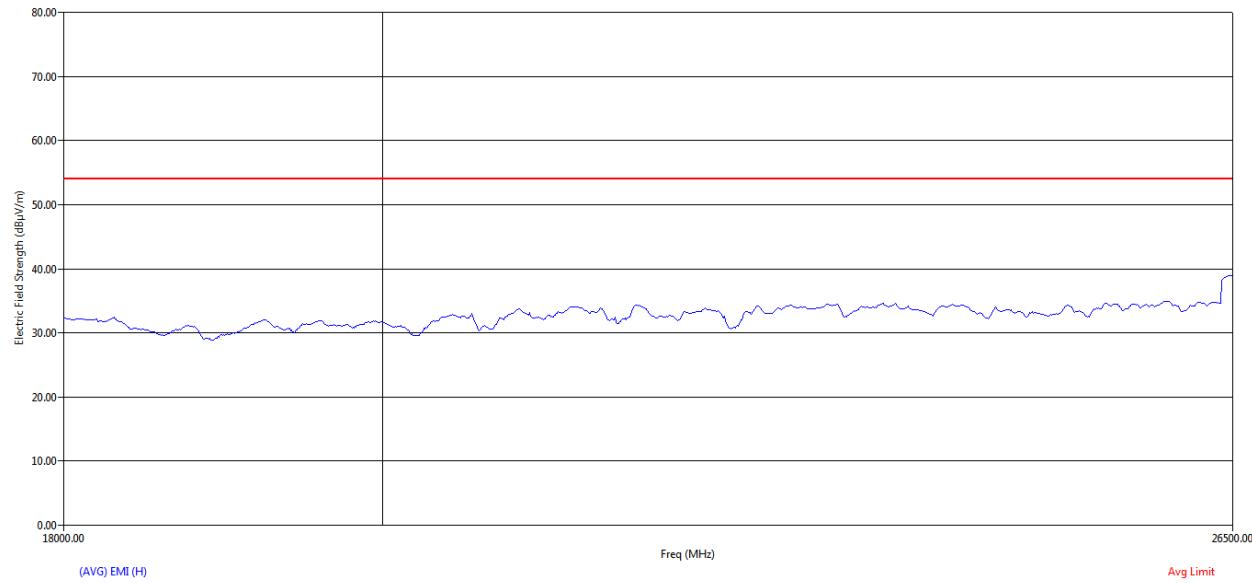
**Figure 55: RE graph from 6 GHz to 18 GHz using Average Detector - Horizontal polarization**



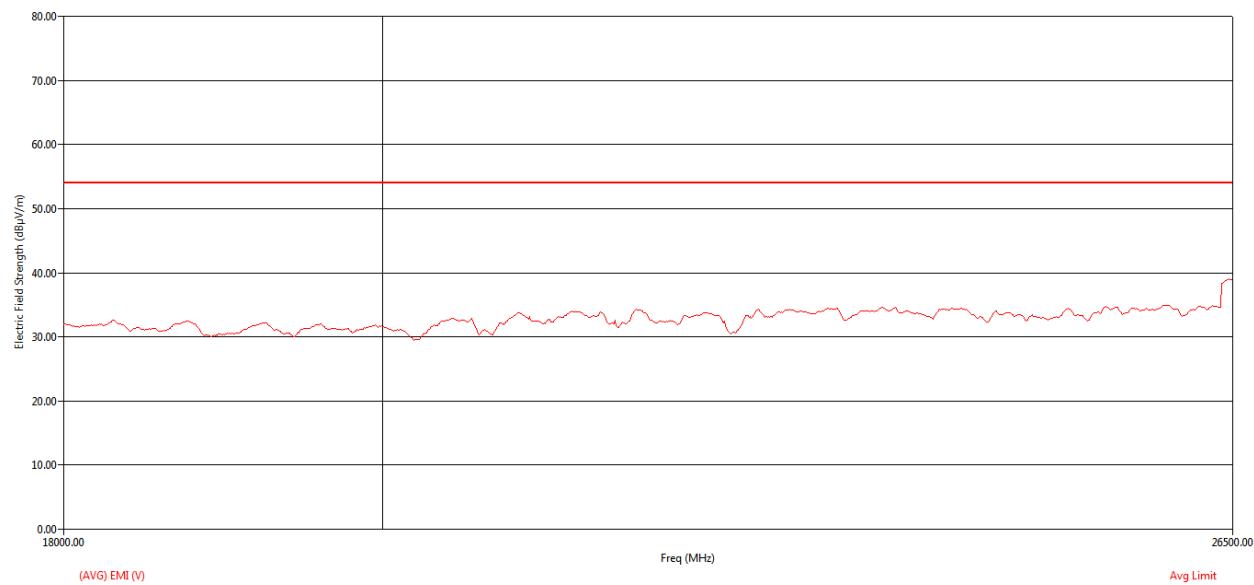
**Figure 56: RE graph from 6 GHz to 18 GHz using Average Detector - Vertical polarization**

Freq (MHz)	Freq (Max) (MHz)	Pol	EUT Ttbl Agl (deg)	Twr Ht (cm)	(AVG) Trace (dBμV)	Cable (dB)	Transducer (dB)	Preamp (dB)	(AVG) EMI (dBμV/m)	AVG Limit (dBμV/m)	(AVG) Margin (dB)
6978.40	6995.88	V	10.80	100.00	34.43	4.21	32.58	28.30	42.92	53.98	-17.08
6987.60	6985.50	H	106.80	100.00	34.83	4.21	32.55	28.30	43.28	53.98	-16.72
7446.40	7447.15	H	134.30	100.00	38.71	4.38	32.97	28.81	47.26	53.98	-12.74
14824.80	14267.76	H	276.70	200.00	30.31	6.22	38.35	28.61	46.27	53.98	-13.73
14976.00	14842.45	V	267.50	100.00	30.11	6.60	39.12	28.21	47.63	53.98	-12.37

**Table 22: Average Table for RE from 6 GHz to 18 GHz**



**Figure 57: RE graph from 18 GHz to 26.5 GHz using Average Detector - Horizontal polarization**



**Figure 58: RE graph from 18 GHz to 26.5 GHz using Average Detector - Vertical polarization**

### 5.3.2.6 RESULT

Radiated Emissions from the EUT are within the specified limit line.

### 5.3.3 EMISSIONS IN RESTRICTED FREQUENCY BANDS

#### 5.3.3.1 TEST SPECIFICATION

<b>Test Standard</b>	47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C, Section §15.205 RSS-Gen, Issue 4, Nov 2014			
<b>Test Procedure</b>	ANSI C63.10-2013			
<b>Frequency Range</b>	9 kHz to 150 kHz	150 kHz to 30 MHz	30 MHz to 1 GHz	1 GHz to 26.5 GHz
<b>Resolution Bandwidth</b>	1 kHz	10 kHz	120 kHz	1 MHz
<b>Video Bandwidth</b>	3 kHz	30 kHz	300 kHz	3 MHz
<b>Step size</b>	400 Hz	4 kHz	40 kHz	400 kHz
<b>Pre Scan Measurement Time</b>	50 ms	50 ms	20 ms	5 ms
<b>Final Measurement Time</b>	1 s	1 s	1 s	1 s
<b>Attenuation</b>	10 dB	10 dB	10 dB	4 dB
<b>Test Distance</b>	3 m	3 m	3 m	3 m
<b>Polarization</b>	Parallel & Perpendicular		Horizontal and Vertical	
<b>Detector</b>	Quasi Peak & Average		Quasi Peak & Average	Average
<b>Input Voltage</b>	3.6 V DC			
<b>Input Frequency</b>	NA			
<b>Temperature</b>	22.1 °C	22.1 °C	23.6 °C	23.0 °C
<b>Humidity</b>	51.6 %	51.6 %	57.8 %	58.0 %
<b>Tested By</b>	Suresh. G.N	Suresh. G.N	Narendra	Narendra
<b>Test Date</b>	20 <sup>th</sup> Jun2015	20 <sup>th</sup> Jun.2015	30 <sup>th</sup> May 2015	12 <sup>th</sup> Jun2015

#### 5.3.3.2 LIMITS

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit (dB<math>\mu</math>V/m) at 3 meter</b>
47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C RSS-Gen, Issue 4, Nov 2014	§15.209, §15.205 8.9 8.10	9 kHz to 490 kHz 490 kHz to 1.705 MHz 1.705 MHz to 30 MHz	128.51 to 93.80* 73.80 to 62.97* 69.54

Note: \* Decreases with the logarithm of the frequency

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit (dB<math>\mu</math>V/m) at 10 meter</b>
47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C	§15.209, §15.205	30 MHz to 88 MHz 88 MHz to 216 MHz 216 MHz to 960 MHz	29.54 33.06 35.56
RSS-Gen, Issue 4, Nov 2014	8.9 8.10	960 MHz to 1000 MHz	43.52

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit (dB<math>\mu</math>V/m) at 3 meter</b>
47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C RSS-Gen, Issue 4, Nov 2014	§15.209, §15.205 8.9 8.10	1000 MHz to 26.5 GHz	53.98

### **5.3.3.3 TEST SETUP**

Refer Section 5.3.2.3 for test setup.

### **5.3.3.4 TEST PROCEDURE**

Refer Section 5.3.2.4 for test procedure.

### **5.3.3.5 MEASUREMENT GRAPHS/DATA**

Refer Section 5.3.2.5 for the graphs and data.

### **5.3.3.6 RESULTS**

Radiated Emissions from the EUT in the restricted bands of operation is within the specified limit line.

### 5.3.4 6 DB BANDWIDTH MEASUREMENT

#### 5.3.4.1 TEST SPECIFICATION

<b>Test Standard</b>	47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C, RSS 247 Issue 1 May 2015
<b>Resolution Bandwidth</b>	100 kHz
<b>Video Bandwidth</b>	300 kHz
<b>Sweep Time</b>	Auto
<b>Test Mode</b>	Conducted
<b>Detector</b>	Peak
<b>Input Voltage</b>	3.6 V DC
<b>Input Frequency</b>	NA
<b>Temperature</b>	21.0 °C
<b>Humidity</b>	54.0 %
<b>Tested By</b>	Narendra
<b>Test Date</b>	22 <sup>nd</sup> June 2015

#### 5.3.4.2 LIMITS

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit (min. 6 dB Bandwidth)</b>
47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C	§15.247 (a) (2)	2400 MHz to 2483.5 MHz	≥ 500 kHz
RSS 247 Issue 1 May 2015	5.2 (1)		

#### 5.3.4.3 TEST SETUP

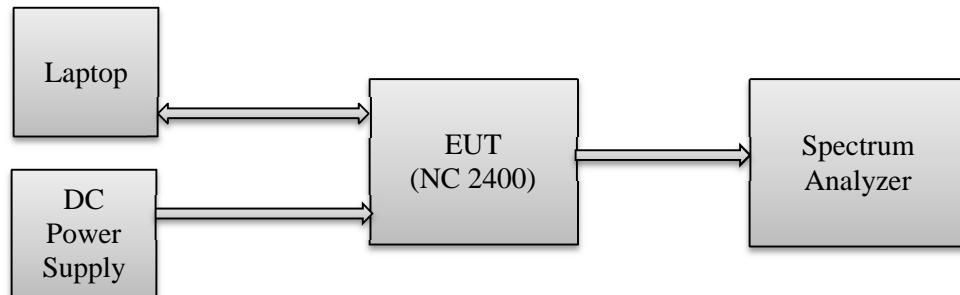


Figure 59: Typical test setup for Conducted RF measurements

#### 5.3.4.4 TEST PROCEDURE

The Conducted test was performed using the Spectrum analyzer. Measurements were done as per the “558074 D01 DTS measurement Guidance v03r02”. The RF output of the EUT was connected to the input port of Spectrum analyzer. Captured the data from spectrum analyzer and compared with the limits specified in the standard.

### 5.3.4.5 MEASUREMENT GRAPHS/DATA

#### LOW CHANNEL CONTINUOUS TX

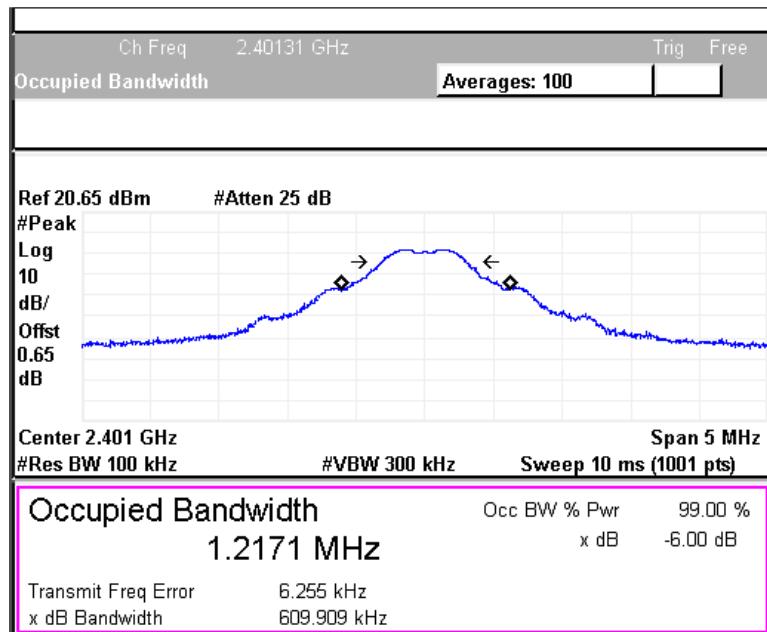


Figure 60: 6 dB Bandwidth measurement for Low Channel

#### MID CHANNEL CONTINUOUS TX

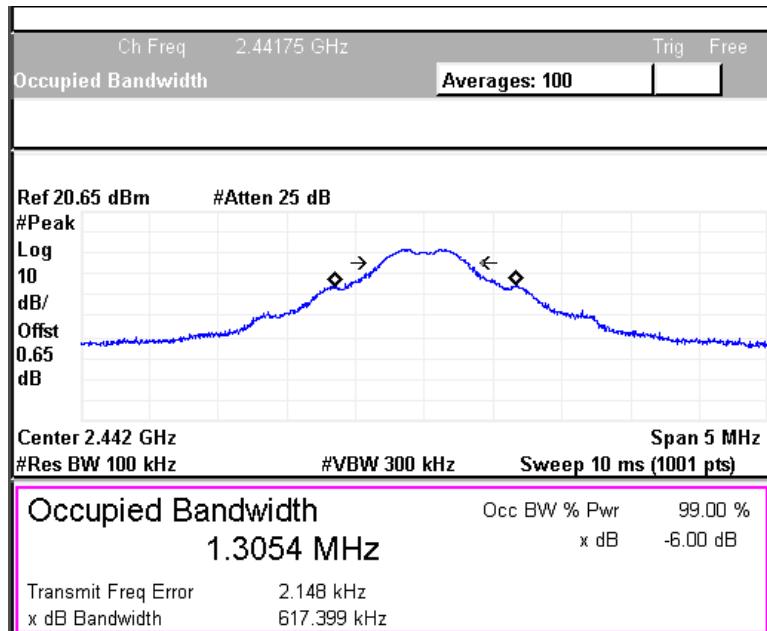


Figure 61: 6 dB Bandwidth measurement for Mid Channel

## HIGH CHANNEL CONTINUOUS TX

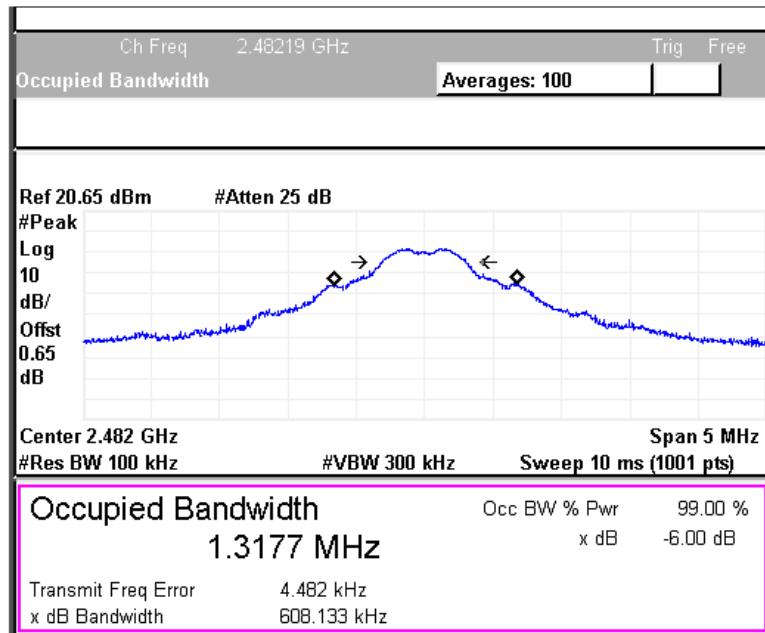


Figure 62: 6 dB Bandwidth measurement for High Channel

### 5.3.4.6 RESULT

The 6 dB Bandwidth for all the channels were found higher than 500 kHz. Refer below table for consolidated data.

Channel Frequency (MHz)	Recorded value (kHz)	Limit (kHz)	Result
LOW	609.909	≥500	PASS
MID	617.399	≥500	PASS
HIGH	608.133	≥500	PASS

### 5.3.5 MAXIMUM CONDUCTED OUTPUT POWER

#### 5.3.5.1 TEST SPECIFICATION

<b>Test Standard</b>	47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C RSS-247 Issue 1, May 2015
<b>Sweep Time</b>	Auto
<b>Attenuation</b>	10 dB
<b>Test Mode</b>	Conducted
<b>Detector</b>	Peak
<b>Input Voltage</b>	3.6 V DC
<b>Input Frequency</b>	NA
<b>Temperature</b>	21.0 °C
<b>Humidity</b>	54.0 %
<b>Tested By</b>	Narendra
<b>Test Date</b>	23 <sup>rd</sup> June 2015

#### 5.3.5.2 LIMITS

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit</b>
47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C RSS 247 Issue 1 May 2015	§15.247 (a) (3) 5.4 (4)	2400 MHz to 2483.5 MHz	≤ 30 dBm (1W)

#### 5.3.5.3 TEST SETUP

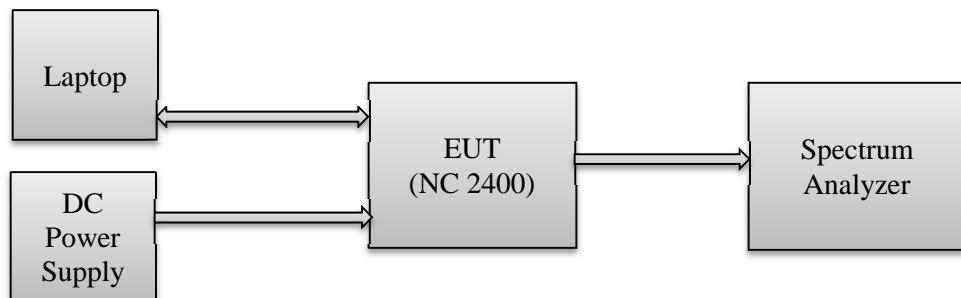


Figure 63: Typical test setup for Conducted RF measurements

#### 5.3.5.4 TEST PROCEDURE

A Broadband Peak RF Power meter is used for output power measurement. Measurements were done as per Section 9.1.2 (Method PKPM1) of KDB “558074 D01 DTS measurement Guidance v03r02”. The RF output of the EUT was connected to the input port of power meter and the result is captured.

### 5.3.5.5 MEASUREMENT GRAPHS / DATA



**Figure 64: Output Power for Low Channel**



**Figure 65: Output Power for Mid Channel**



**Figure 66: Output Power for High Channel**

### 5.3.5.6 TEST RESULT:

Maximum conducted output power for all channels is within the specified limits. Refer below table for consolidated data.

Channel Frequency (MHz)	Peak Conducted Output Power(dBm)	Limit (dBm)	Result
LOW	2.14	30	PASS
MID	1.95	30	PASS
HIGH	1.71	30	PASS

*Note: EUT was operated with 100% duty cycle*

## 5.3.6 POWER SPECTRUM DENSITY

### 5.3.6.1 TEST SPECIFICATION

<b>Test Standard</b>	47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C RSS-247 Issue 1, May 2015
<b>Frequency Range</b>	2400 MHz to 2483 MHz
<b>Resolution Bandwidth</b>	10 kHz
<b>Video Bandwidth</b>	30 kHz
<b>Sweep Time</b>	Auto
<b>Test Mode</b>	Conducted
<b>Detector</b>	Peak
<b>Input Voltage</b>	3.6 V DC
<b>Input Frequency</b>	NA
<b>Temperature</b>	21.0 °C
<b>Humidity</b>	54.0 %
<b>Tested By</b>	Narendra
<b>Test Date</b>	22 <sup>nd</sup> June 2015

### 5.3.6.2 LIMITS

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit</b>
47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C	§15.247 (e)	2400 MHz to 2483.5 MHz	≤ 8dBm in any 3 kHz band
RSS-247, Issue 1, May 2015	5.2(2)		

### 5.3.6.3 TEST SETUP

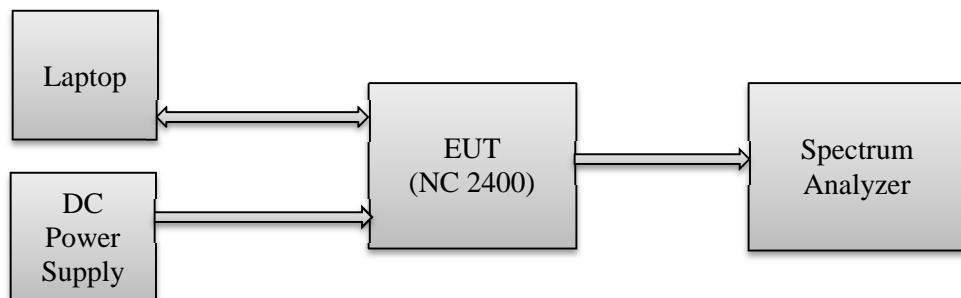


Figure 67: Typical test setup for Conducted RF measurements

### 5.3.6.4 TEST PROCEDURE

The Conducted test was performed using the Spectrum analyzer. Measurements were done as per KDB “558074 D01 DTS measurement Guidance v03r02”. The RF output of the EUT was connected to the input port of Spectrum analyzer using an attenuator. Captured the data from spectrum analyzer and compared with the limits specified in the standard.

### 5.3.6.5 MEASUREMENT GRAPHS / DATA

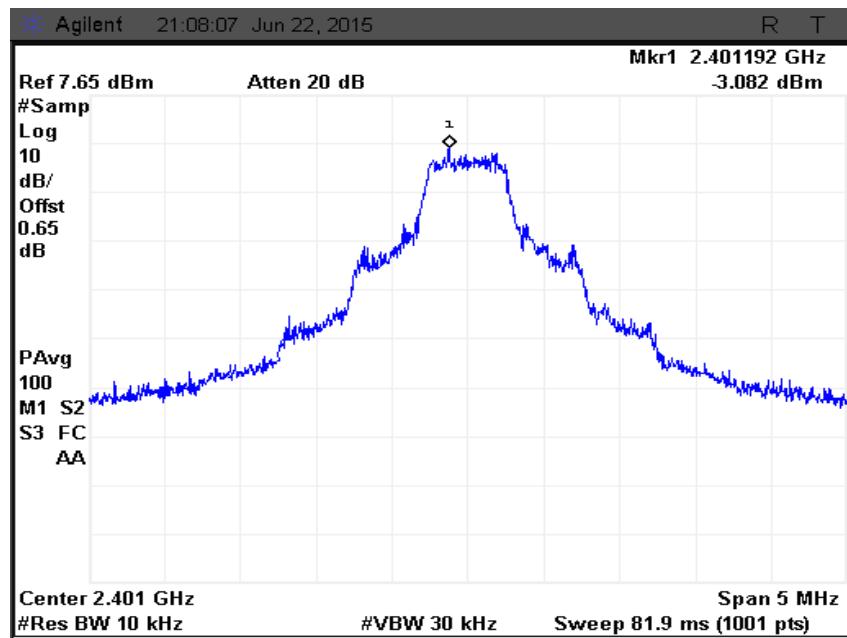


Figure 68: Measurement for Low Channel

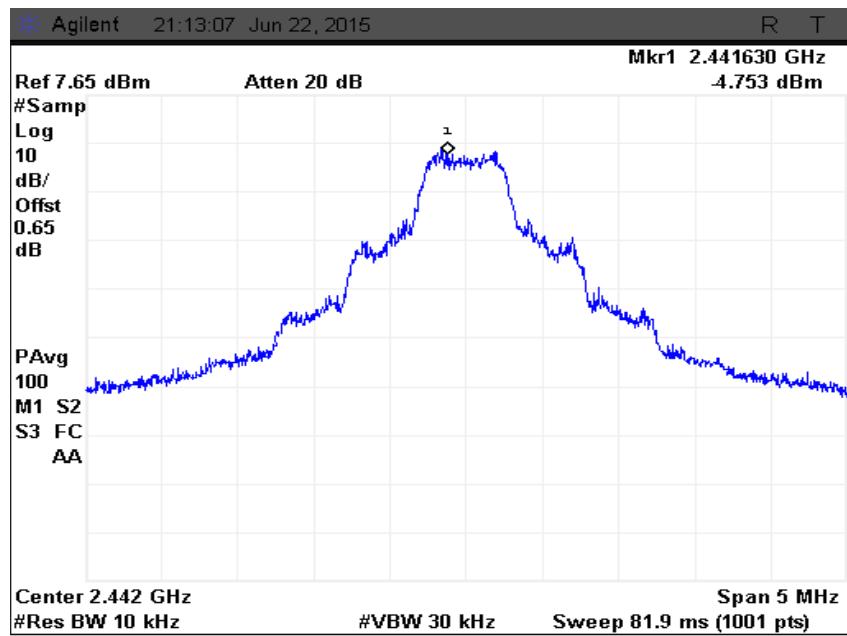
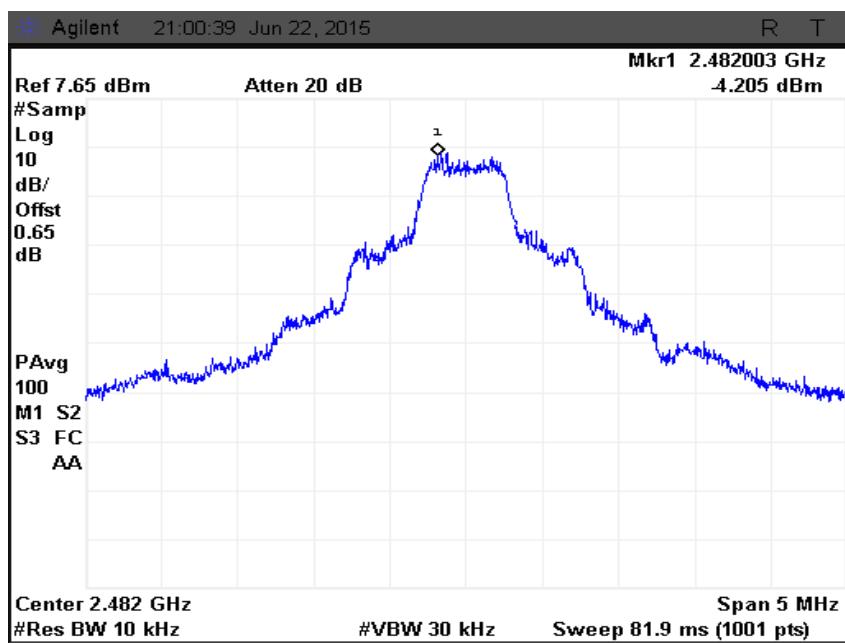


Figure 69: Measurement for Mid Channel



**Figure 70: Measurement for High Channel**

### 5.3.6.6 RESULT

Power Spectral Density for all channels are within the specified limit. Refer below table for consolidated result.

Channel	Recorded value (dBm/10 kHz)	Calculated Value (dBm/3 kHz)	Limit (dBm/3 kHz)	Result
LOW	-3.023	-8.253	8	PASS
MID	-4.753	-9.983	8	PASS
HIGH	-4.205	-9.435	8	PASS

*Note: Bandwidth correction Factor =  $10\log (3 \text{ KHz}/10\text{kHz})$*

## 5.3.7 RADIO FREQUENCY POWER IN ANY 100 kHz BANDWIDTH OUTSIDE THE INTENTIONAL BAND

### 5.3.7.1 TEST SPECIFICATION

<b>Test Standard</b>	47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C RSS-247 Issue 1, May 2015
<b>Frequency Range</b>	20 MHz to 26.5 GHz
<b>Resolution Bandwidth</b>	100 kHz
<b>Video Bandwidth</b>	300 kHz
<b>Sweep Time</b>	Auto
<b>Test Mode</b>	Conducted
<b>Detector</b>	Peak
<b>Input Voltage</b>	3.6 V DC
<b>Input Frequency</b>	NA
<b>Temperature</b>	21.0 °C
<b>Humidity</b>	54.0 %
<b>Tested By</b>	Narendra
<b>Test Date</b>	23 <sup>rd</sup> June 2015

### 5.3.7.2 LIMITS

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit</b>
47 CFR Ch. I (10–1–13 Ed), Part 15, Subpart C	§15.247 (d)	2400 MHz to 2483.5 MHz	-20 dB in any 100 kHz band outside the Intentional band
RSS-247 Issue 1, May 2015	5.5		

### 5.3.7.3 TEST SETUP

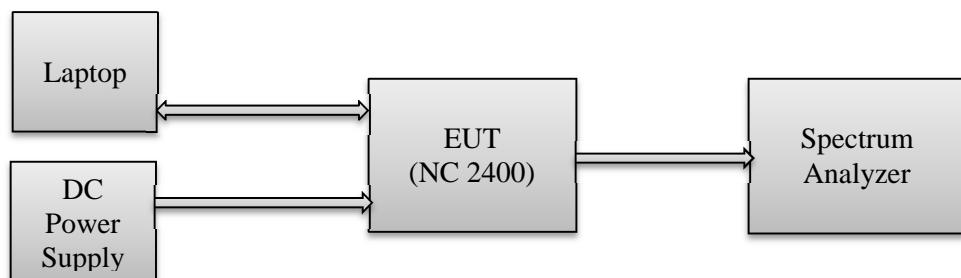


Figure 71: Typical test setup for Conducted RF measurements

### 5.3.7.4 TEST PROCEDURE

The Conducted test was performed using the Spectrum analyzer. Measurements were done as per Section 11.3 of KDB “558074 D01 DTS measurement Guidance v03r02”. The RF output of the EUT was connected to the input port of Spectrum analyzer using an attenuator. Captured the data from spectrum analyzer and compared with the limits specified in the standard

### 5.3.7.5 MEASUREMENT GRAPHS / DATA

#### LOW CHANNEL

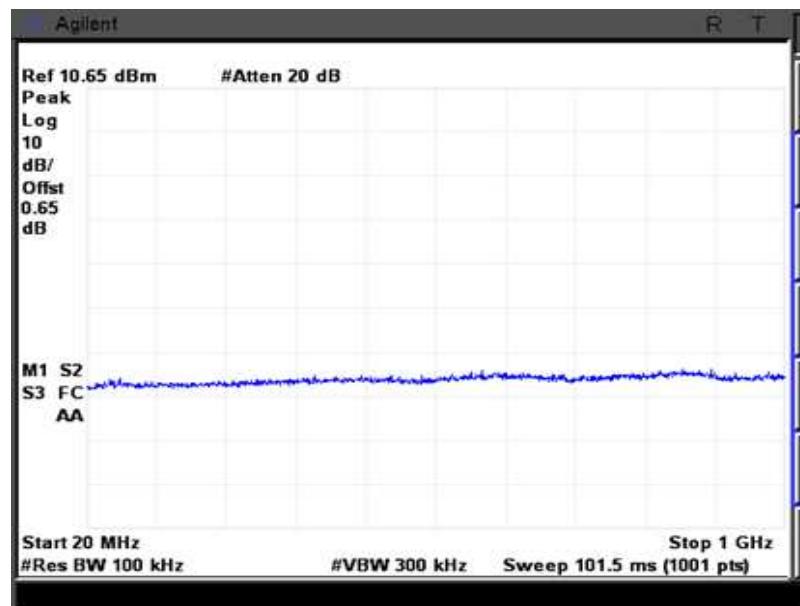


Figure 72: Spurious Emissions from 20 MHz to 1 GHz

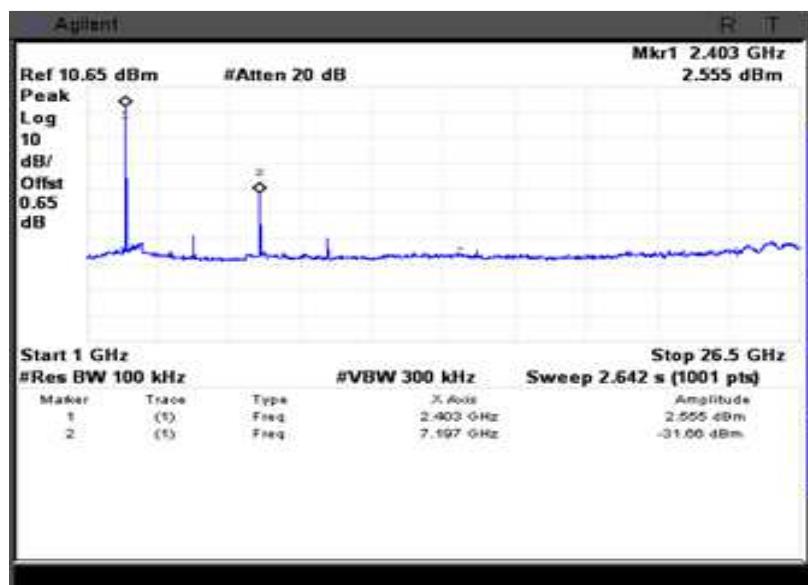


Figure 73: Spurious Emissions from 1 GHz to 26.5 GHz

## MID CHANNEL

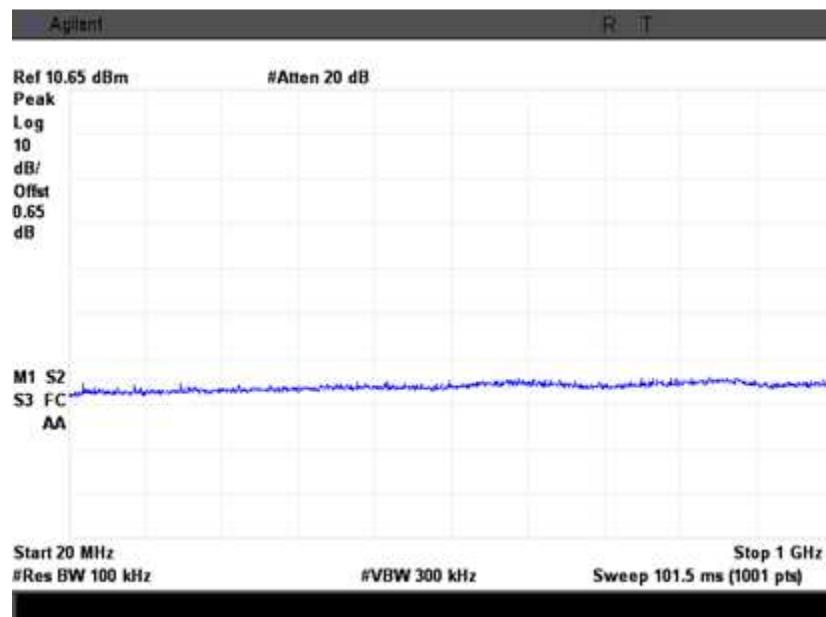


Figure 74: Spurious Emissions from 20 MHz to 1 GHz

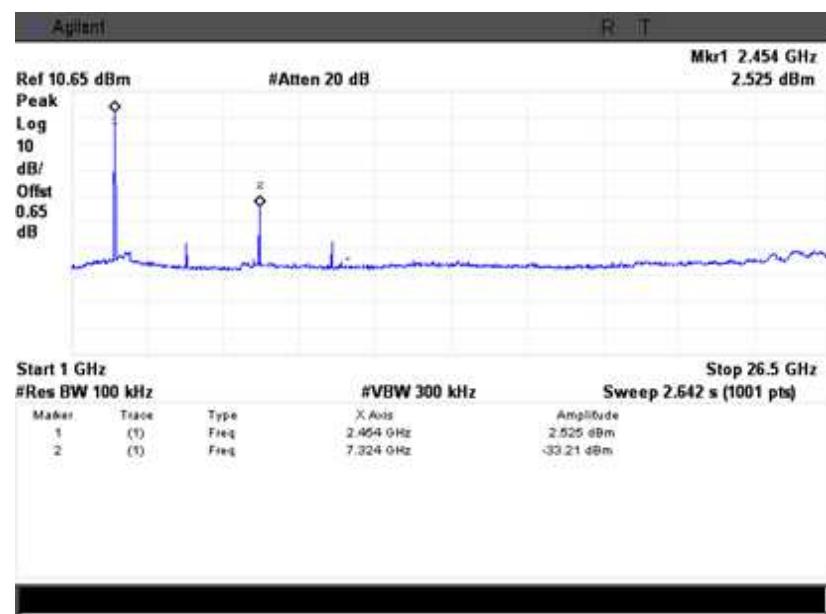


Figure 75: Spurious Emissions from 1 GHz to 26.5 GHz

## HIGH CHANNEL

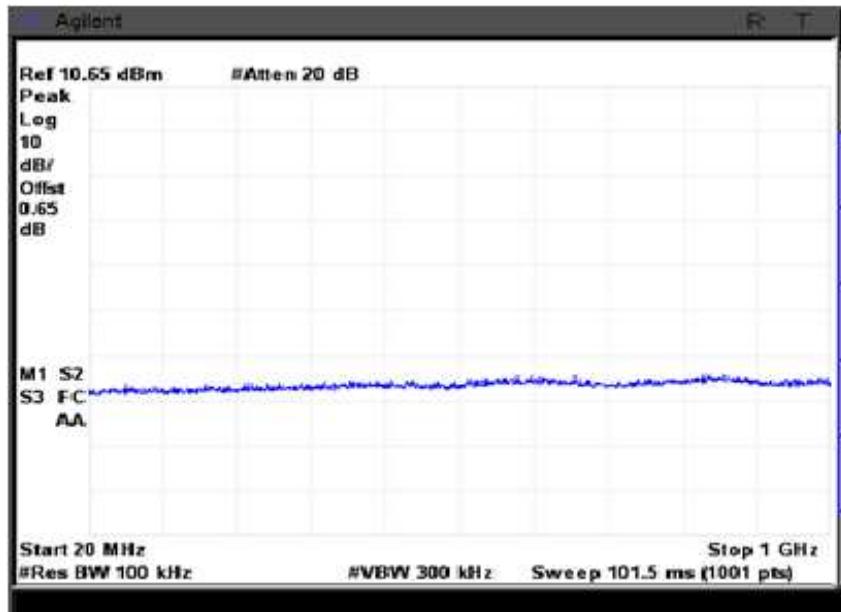


Figure 76: Spurious Emissions from 20 MHz to 1 GHz

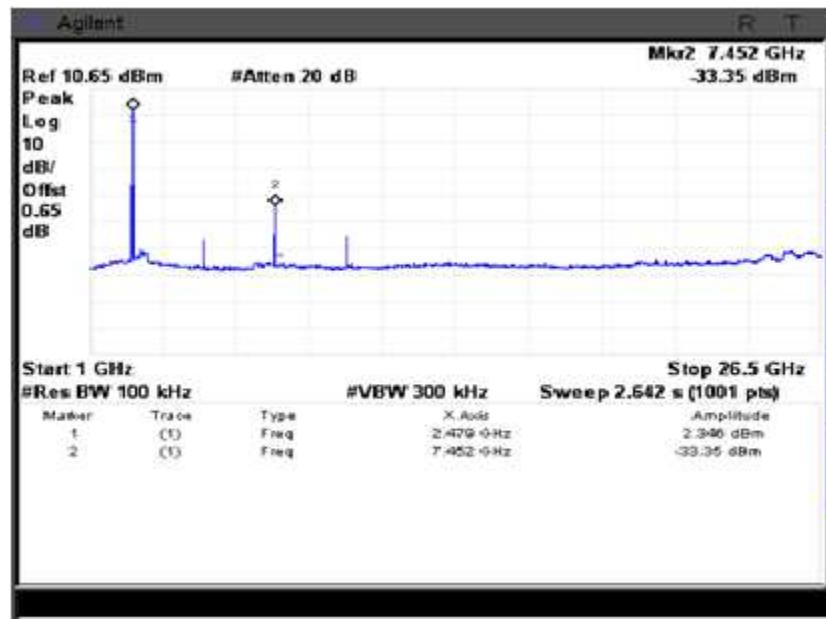


Figure 77: Spurious Emissions from 1 GHz to 26.5 GHz

### 5.3.7.6 RESULT

Radio frequency power in any 100 kHz bandwidth outside the intentional band is below -20dB from the carrier in all channels.

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*This report should always be reproduced in full. Any extracts of this report is invalid.*

### 5.3.8 OPERATING BAND EDGE MEASUREMENT

#### 5.3.8.1 TEST SPECIFICATION

<b>Test Standard</b>	47 CFR Ch. I (10-1-13 Ed), Part 15, Subpart C RSS-247 Issue 1, May 2015
<b>Frequency Range</b>	2400 MHz to 2483.5 MHz
<b>Resolution Bandwidth</b>	100 kHz
<b>Video Bandwidth</b>	300 kHz
<b>Span</b>	2 MHz
<b>Test Mode</b>	Conducted
<b>Detector</b>	RMS
<b>Input Voltage</b>	3.6 V DC
<b>Input Frequency</b>	NA
<b>Temperature</b>	21.0 °C
<b>Humidity</b>	54.0 %
<b>Tested By</b>	Narendra
<b>Test Date</b>	22 <sup>nd</sup> June 2015

#### 5.3.8.2 LIMITS

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit</b>
47 CFR Ch. I (10-1-13 Ed), Part 15, Subpart C	§15.247 (d)	2400 MHz to 2483.5 MHz	30dB below the maximum in- band average PSD level
RSS-247 Issue 1, May 2015	5.5		

#### 5.3.8.3 TEST SETUP

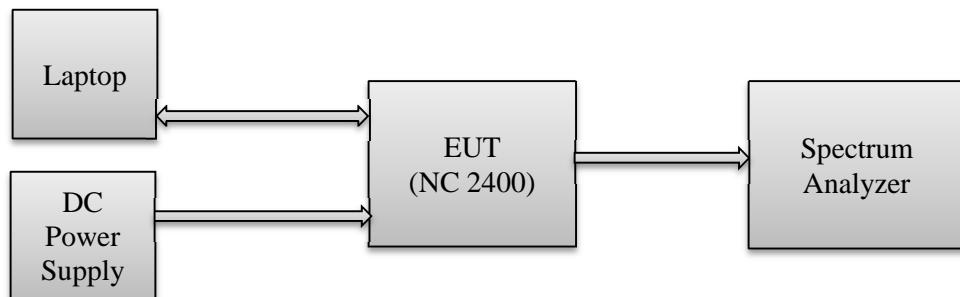


Figure 78: Typical test setup for Conducted RF measurements

#### 5.3.8.4 TEST PROCEDURE

The Conducted test was performed using the Spectrum analyzer. Measurements were done as per Section 13 of KDB “558074 D01 DTS measurement Guidance v03r02”. The RF output of the EUT was connected to the input port of Spectrum analyzer using an attenuator. Captured the data from spectrum analyzer and compared with the limits specified in the standard.

### 5.3.8.5 MEASUREMENT GRAPHS / DATA

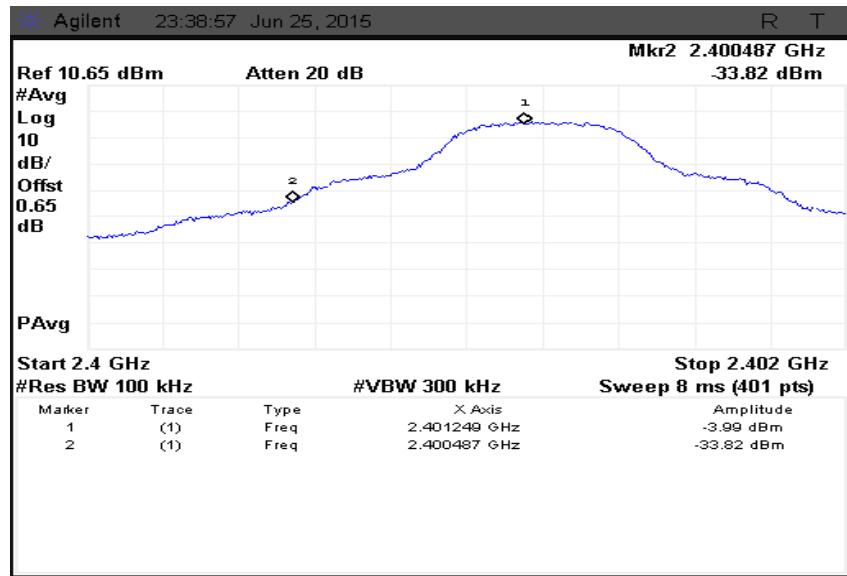


Figure 79: Band Edge Measurement at Low channel

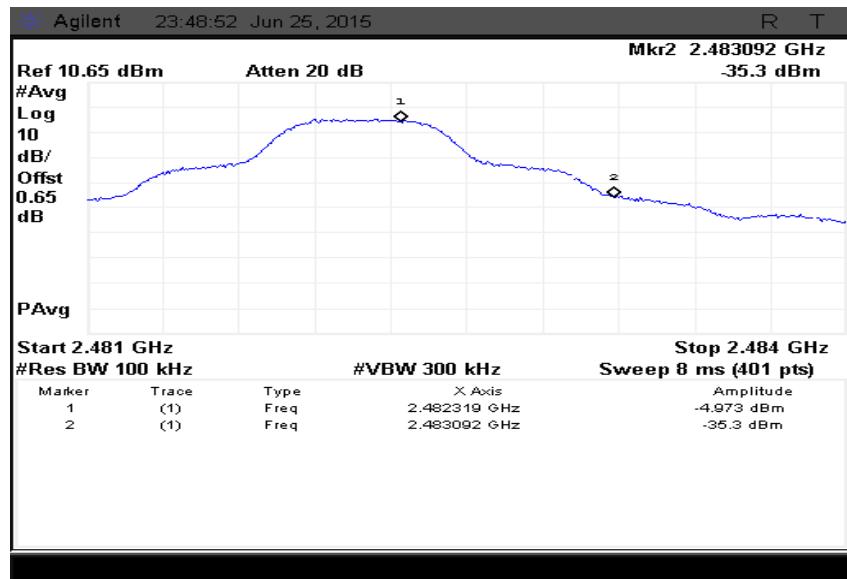


Figure 80: Band Edge Measurement at High Channel

### 5.3.8.6 RESULT

Operating band edge is below -30 dB from the carrier in all channels.

## ANNEXURE I: ACRONYMS

dB	Decibel
dB $\mu$ V	Decibel micro Volts
EUT	Equipment Under Test
FCC	Federal Communications Commission
GHz	Giga Hertz
kHz	Kilo Hertz
LISN	Line Impedance Stabilization Network
MHz	Mega Hertz
QP	Quasi Peak

**END OF REPORT**