

## EMC TEST REPORT

<b>TEST REPORT NUMBER</b>	DBN 1613TEL660-F
<b>TEST REPORT DATE</b>	23-Jun-2016
<b>TEST REPORT VERSION</b>	1.0
<b>MANUFACTURER</b>	Cambium Networks
<b>PRODUCT NAME</b>	ePMP2000
<b>PRODUCT MODEL</b>	C050900P031A
<b>CONDITION OF EUT WHEN RECEIVED</b>	GOOD and in proper working condition
<b>ISSUED TO</b>	Cambium Networks, 3800 Golf Road, Suite 360, Rolling Meadows, IL, USA 60008
<b>ISSUED BY</b>	<p><b>TARANG Lab</b>            Wipro Technologies, SJP2, Survey#70,77,78/8A,            Dodd 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></p>

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## AMENDMENT HISTORY

Amendment Number	Amendment Date	Author of Amendment	Previous Report Version	Previous Report Date
<b>Amendment Details</b>				

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## 1 TEST REPORT SUMMARY

<b>Applicant</b>	Cambium Networks
<b>Manufacturer</b>	Cambium Networks
<b>Product Name</b>	ePMP2000
<b>Product Model</b>	C050900P031A
<b>Product Serial Number</b>	000456D1846A
<b>Date of Test</b>	18 <sup>th</sup> Mar 2016 to 26 <sup>th</sup> Apr 2016
<b>Venue of Test</b>	Tarang Lab

<b>Applicable Standard</b>	<b>Description</b>	<b>Results</b>
RSS GEN, Issue 4, Nov 2014, RSS 247 Issue 1 May 2015	Duty Cycle(X) and Transmission Duration(T)	NA
	26 dB Bandwidth measurement	NA
	RSS 247 6.2.2 (1) - 99% Occupied channel bandwidth	NA
	RSS 247 6.2.2 (1)-Maximum conducted output power	PASS
	RSS 247 6.2.2 (1)-Power spectral density	PASS
	RSS 247 6.2.2 (2)-Transmitter unwanted emission (Conducted)	PASS
	RSS 247 6.2.2 (2)- Band edge measurements	PASS

**ePMP2000** 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.

Prepared by	Reviewed by	Approved by
		
Dikshit Raviteja	Arun Kumar N C	Satheesh I
<b>EMI/EMC Test Engineer</b>	<b>Lead EMI/EMC Test Engineer</b>	<b>Technical Manager</b>

## 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

NA

### 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
Spectrum Analyzer	Keysight Technologies	N9020A	MY54420183	05 <sup>th</sup> Jul 2016
X series USB Peak and Average Power sensor	Keysight Technologies	U2021XA	MY55050001	05 <sup>th</sup> Jul 2016
X series USB Peak and Average Power sensor	Keysight Technologies	U2021XA	MY55050002	05 <sup>th</sup> Jul 2016
EMI Test Receiver	R&S	ESIB40	100306	21 <sup>st</sup> Jan 2017 & 04 <sup>th</sup> Jul 2016

Table 1: List of Equipment used for Conducted RF Test

## 4 PRODUCT INFORMATION

### 4.1 DESCRIPTION OF THE PRODUCT

EUT is a point to point & point to multipoint fixed outdoor Transceiver with the following defined channels.

<b>40 MHz channel for 17 dBi antenna</b>	<b>10 MHz channel for 17 dBi antenna</b>
Low – 5280 MHz	Low – 5265 MHz
Mid - 5300 MHz	Mid – 5300 MHz
High - 5320 MHz	High – 5335 MHz

<b>Product</b>	ePMP2000
<b>Model Number</b>	C050900P031A
<b>Serial Number</b>	000456D1846A
<b>Product Category / Type of Equipment</b>	ITE
<b>EUT Operating Voltage</b>	120 V AC
<b>EUT Operating frequency range</b>	60 Hz
<b>Max EUT Operating Current</b>	< 1 A

Table 2: EUT details

<b>Cable No.</b>	<b>Cable Name</b>	<b>Cable Length</b>	<b>Power / Interconnection cable</b>	<b>Shielded / Unshielded</b>
Cable - 1	Power cable	0.8 meter	Power	Unshielded
Cable - 2	Ethernet Cable	1.5 meter	Interconnection	Unshielded
Cable - 3	Ethernet Cable	3.0 meter	Interconnection	Unshielded

Table 3: List of cables

### 4.2 SOFTWARE AND FIRMWARE DETAILS

Atheros Radio Test 2 (ART2-GUI) Version 2.3

## 5 TEST DETAILS

### 5.1 PRODUCT AND TEST SETUP

#### 5.1.1 PRODUCT CONFIGURATION

The EUT was powered through AC power supply (120 V AC / 60 Hz). The EUT was connected to Ethernet switch by using RJ45 cable. Figure 1 shows the product configuration during the tests. POE module was used during the test to power ON the EUT.

The 5.2 GHz ePMP Integrated Radio was configured with test software and configured to have the following settings during the course of testing:

- 40 MHz modulation bandwidth for low, mid & high channels
  - Rate - HT40,
  - 54 Mbps OFDM, MCS15 / 270 Mbps
  - Tx Power is 11 dBm Tx99 for 17 dBi antenna configuration-Low channel
  - Tx Power is 11 dBm Tx99 for 17 dBi antenna configuration-Mid channel
  - Tx Power is 11.5 dBm Tx99 for 17 dBi antenna configuration-High channel
- 10 MHz modulation bandwidth for low, mid & high channels
  - Rate – Legacy,
  - 54 Mbps OFDM, MCS15 / 130 Mbps
  - Tx Power is 9 dBm Tx99 for 17 dBi antenna configuration-Low channel
  - Tx Power is 10 dBm Tx99 for 17 dBi antenna configuration-Mid channel
  - Tx Power is 10 dBm Tx99 for 17 dBi antenna configuration-High channel
- Additional measurements as requested by the customer at the band edges of the 5.2 GHz band
  - Low channel (5270 MHz) Tx Power is 13 dBm for 40 MHz modulation bandwidth
  - High channel (5330 MHz) Tx Power is 13 dBm for 40 MHz modulation bandwidth
  - Low channel (5255 MHz) Tx Power is 8 dBm for 10 MHz modulation bandwidth.
  - High channel (5345 MHz) Tx Power is 8.5 dBm for 10 MHz modulation bandwidth.

The unit was continuously monitored for transmission using an auxiliary antenna during the radiated tests.

## 5.1.2 TEST SETUP DETAILS

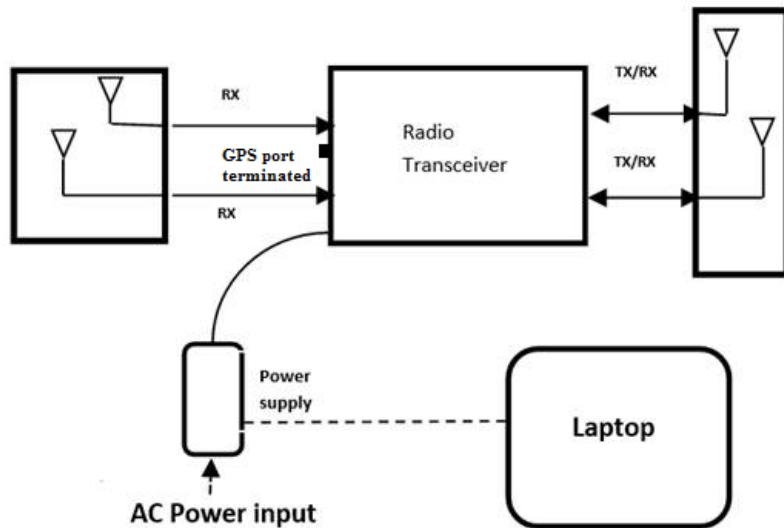


Figure 1: Block diagram of the EUT test setup

## 5.1.3 ACCESSORIES

Name of the Equipment	Manufacturer	Model Number	Serial Number
17 dBi Antenna Beam steer- Rx	Cambium Networks	C050900D020A	NA
17 dBi Antenna sector- Tx	Cambium Networks	C050900D021A	NA
Power Supply	Cambium Networks	NET P30 56	031-326-6719
Switching Power Supply Gigabit Compatible	Cambium Networks	NET-P30-56	N000000L034A

## 5.2 APPLICABLE TESTS

Applicable Standard	Description	Test level / Test Voltage	Applicability
RSS GEN Issue – May 2015 RSS GEN – Issue 4 Nov 2014	Duty Cycle(X) and Transmission Duration(T)	NA	Antenna port
	26 dB Bandwidth measurement	NA	Antenna port
	99% Occupied Channel Bandwidth	NA	Antenna port
	Maximum Conducted Output Power	$\leq 250$ mW	Antenna port
	Power Spectral Density	$\leq 11$ dBm in 1 MHz bandwidth	Antenna port
	Transmitter Unwanted emissions (Conducted)	9 kHz - 40 GHz	Antenna port
	Band edge measurements	$\leq -27$ dBm/MHz	Antenna port

## 5.3 TEST RESULT

### 5.3.1 DUTY CYCLE (X) AND TRANSMISSION DURATION (T)

#### 5.3.1.1 TEST SPECIFICATION

<b>Test Standard</b>	RSS 247 Issue 1 May 2015
<b>Test Procedure</b>	789033 D2 General U-NII Test Procedures New Rule v01r01
<b>Frequency Range</b>	5250-5350 MHz
<b>Resolution Bandwidth</b>	3 MHz
<b>Video Bandwidth</b>	50 MHz
<b>Sweep Time</b>	Auto
<b>Attenuation</b>	Auto
<b>Test Mode</b>	Conducted
<b>Detector</b>	RMS
<b>Input Voltage</b>	120 V AC
<b>Input Frequency</b>	60 Hz
<b>Temperature</b>	21.0 °C
<b>Humidity</b>	54.0 %
<b>Tested By</b>	Suresh.G.N
<b>Test Date</b>	18 <sup>th</sup> Mar 2016

#### 5.3.1.2 LIMITS

NA

#### 5.3.1.3 TEST SETUP



Figure 2: Typical test setup for Conducted RF Test

#### 5.3.1.4 TEST PROCEDURE

The Conducted test was performed using the Spectrum analyzer. Measurements were done as per section II B of “**789033 D2 General U-NII Test Procedures New Rule V01r01**”. The RF output of the EUT was connected to the input port of Spectrum analyzer using an attenuator. The graph and data captured from spectrum analyzer and recorded.

### 5.3.1.5 MEASUREMENT GRAPHS / DATA



Figure 3: Measured ON time



Figure 4: Measured Transmission Period (T)

### 5.3.1.6 RESULT

The Duty cycle and Transmission duration data were recorded.

Mode	ON time ( $\mu$ sec)	T ( $\mu$ sec)	Duty Cycle X (Linear)	Duty Cycle (%)	50/T Minimum RBW and VBW (kHz)
Tx ON	86.67	117.3	0.7389	73.89%	426.25

*Note: Duty cycle = (ON time / Period)\*100*

### 5.3.2 26 dB BANDWIDTH MEASUREMENT

#### 5.3.2.1 TEST SPECIFICATION

<b>Test Standard</b>	RSS 247 Issue 1 May 2015
<b>Test Procedure</b>	789033 D2 General U-NII Test Procedures New Rule V01r01
<b>Frequency Range</b>	5250-5350 MHz
<b>Resolution Bandwidth</b>	100 kHz, 390 kHz
<b>Video Bandwidth</b>	300 kHz, 1.2 MHz
<b>Sweep Time</b>	Auto
<b>Attenuation</b>	Auto
<b>Test Mode</b>	Conducted
<b>Detector</b>	Peak
<b>Input Voltage</b>	120 V AC
<b>Input Frequency</b>	60 Hz
<b>Temperature</b>	23.0 °C
<b>Humidity</b>	55.0 %
<b>Tested By</b>	Suresh.G.N
<b>Test Date</b>	18 <sup>th</sup> Mar 2016

#### 5.3.2.2 LIMITS

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit</b>
RSS 247 Issue 1 May 2015	NA	5250 MHz to 5350 MHz	NA

#### 5.3.2.3 TEST SETUP



Figure 5: Typical test setup for Conducted RF Test

#### 5.3.2.4 TEST PROCEDURE

The Conducted test was performed using the Spectrum analyzer. Measurements were done as per the “**789033 D2 General U-NII Test Procedures New Rule V01r01**”. The RF output of the EUT was connected to the input port of Spectrum analyzer using an attenuator. The graph and data captured from spectrum analyzer and recorded.

### 5.3.2.5 MEASUREMENT GRAPHS / DATA

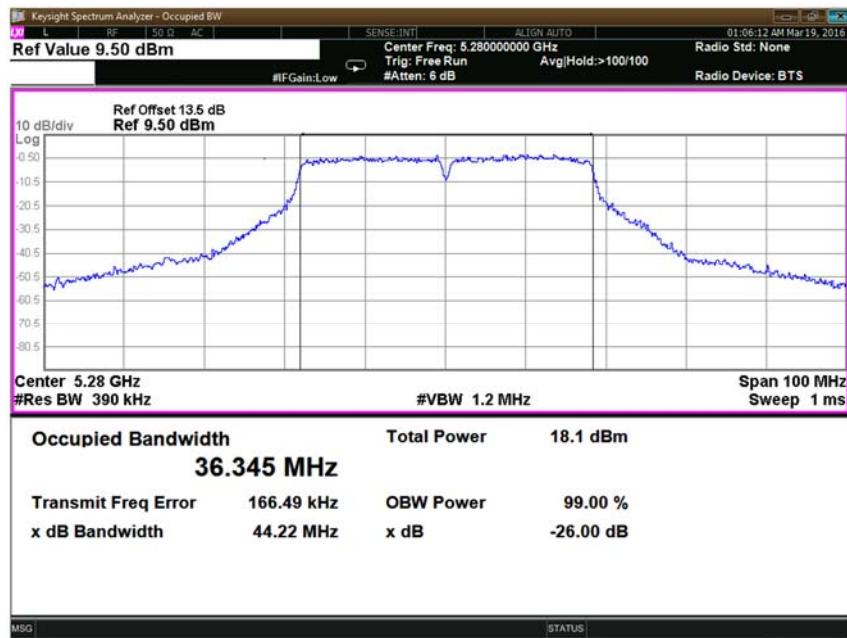


Figure 6: 40 MHz, 17 dBi, Low channel: 26 dB bandwidth measured at Ch.0 – 5280 MHz

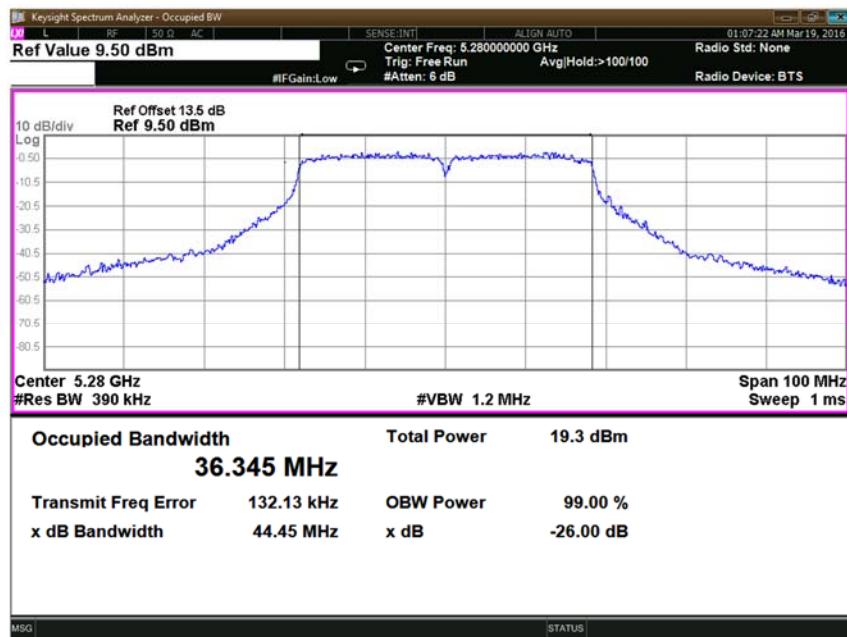


Figure 7: 40 MHz, 17 dBi, Low channel: 26 dB bandwidth measured at Ch.1– 5280 MHz

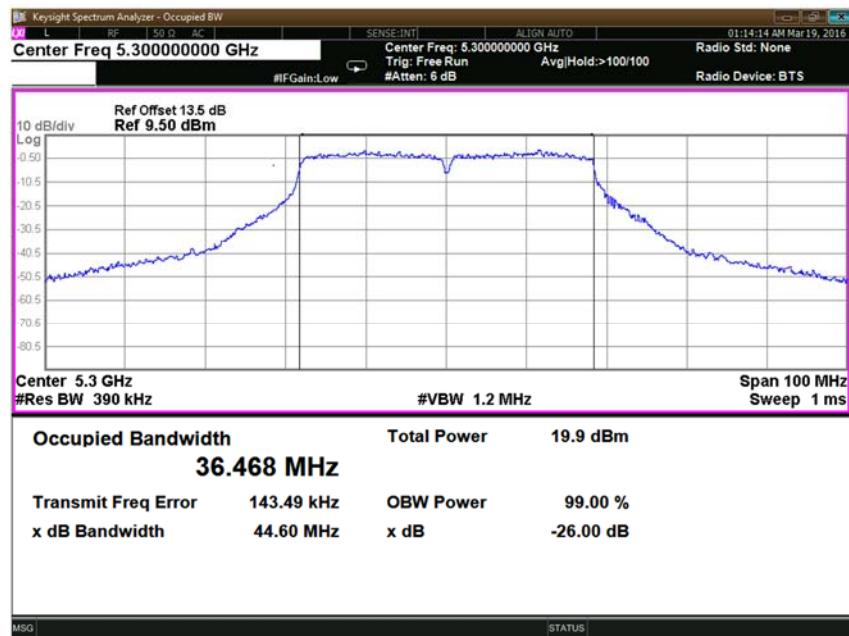


Figure 8: 40 MHz, 17 dBi, Mid channel: 26 dB bandwidth measured at Ch.0 - 5300 MHz

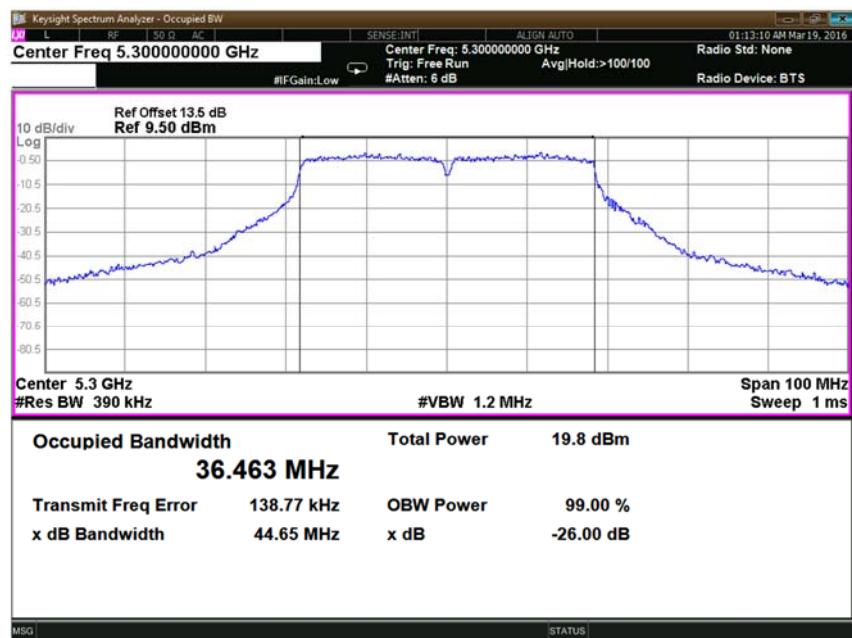


Figure 9: 40 MHz, 17 dBi, Mid channel: 26 dB bandwidth measured at Ch.1 - 5300 MHz

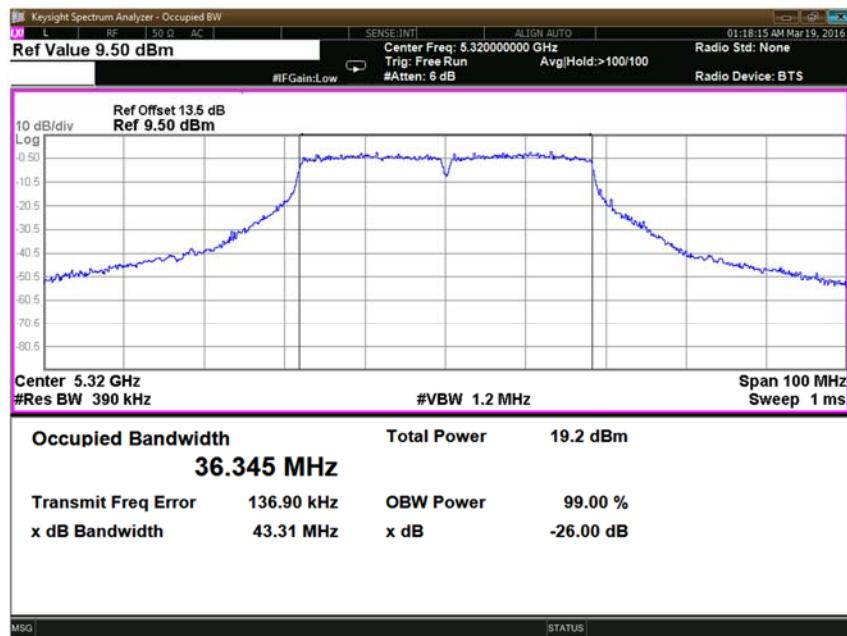


Figure 10: 40 MHz, 17 dBi, High channel: 26 dB bandwidth measured at Ch.0 - 5320 MHz

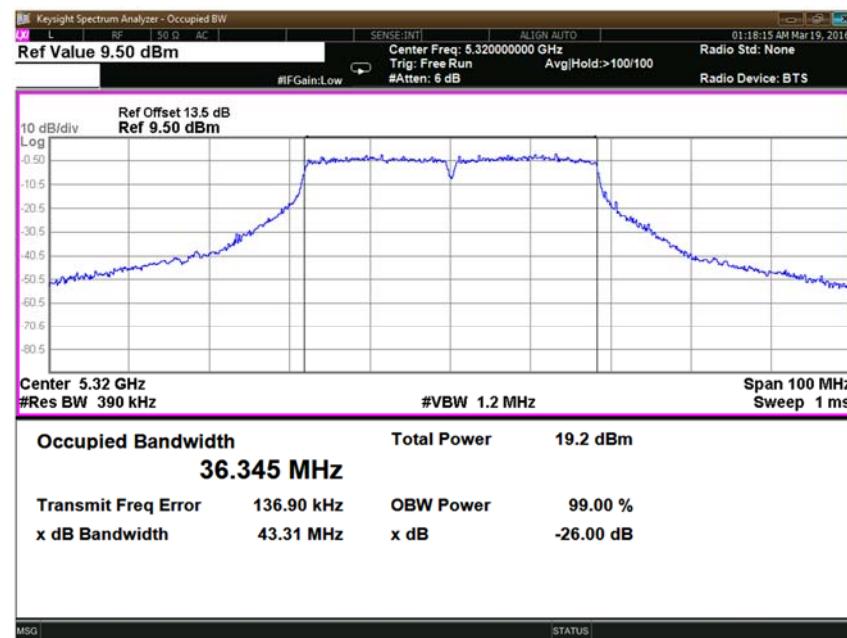


Figure 11: 40 MHz, 17 dBi, High channel: 26 dB bandwidth measured at Ch.1 - 5320 MHz

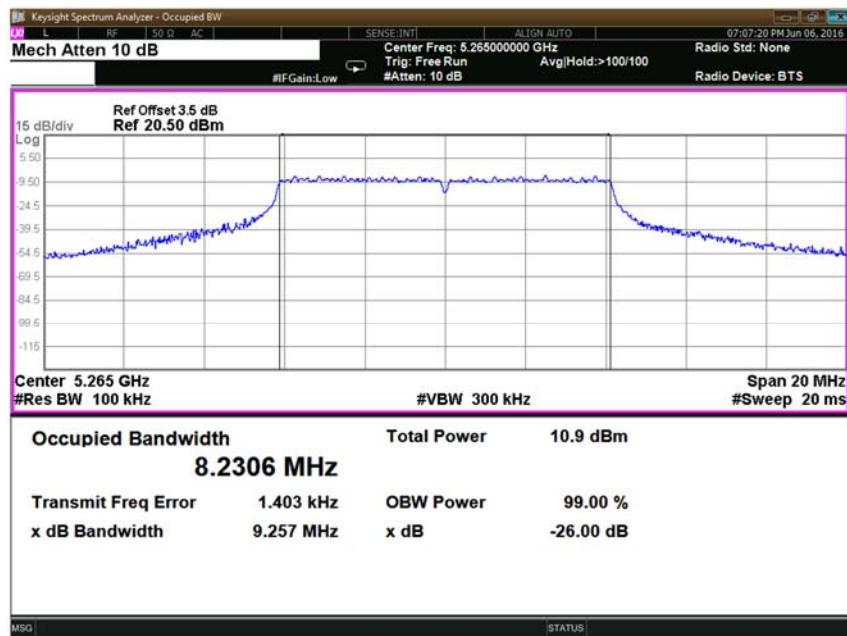


Figure 12: 10 MHz, 17 dBi, Low channel: 26 dB bandwidth measured at Ch.0 - 5265 MHz

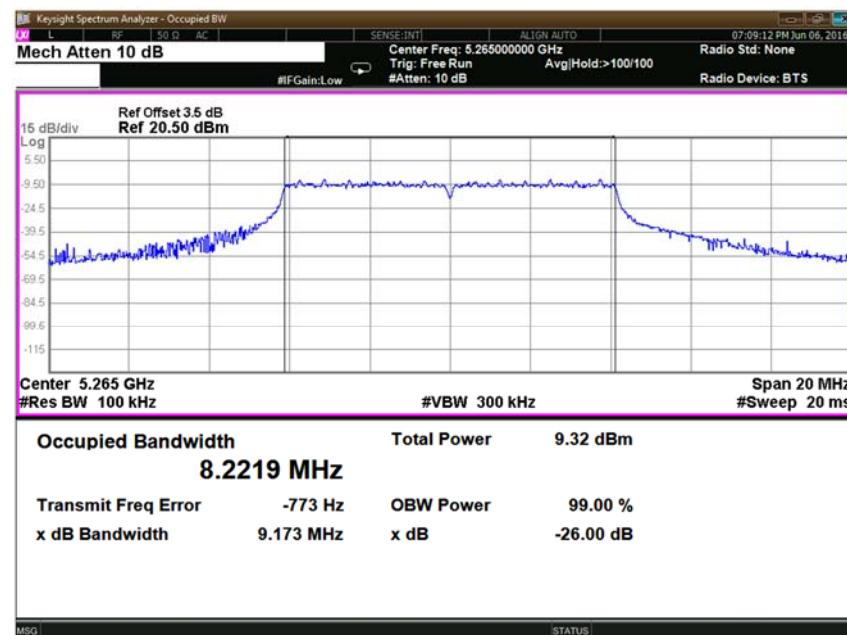


Figure 13: 10 MHz, 17 dBi, Low channel: 26 dB bandwidth measured at Ch.1 - 5265 MHz

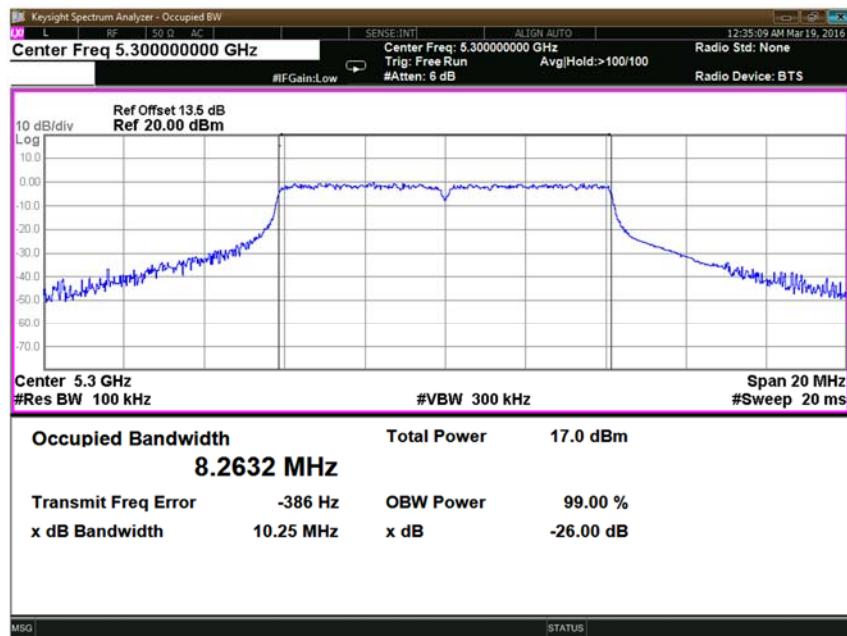


Figure 14: 10 MHz, 17 dBi, Mid channel: 26 dB bandwidth measured at Ch.0 - 5300 MHz

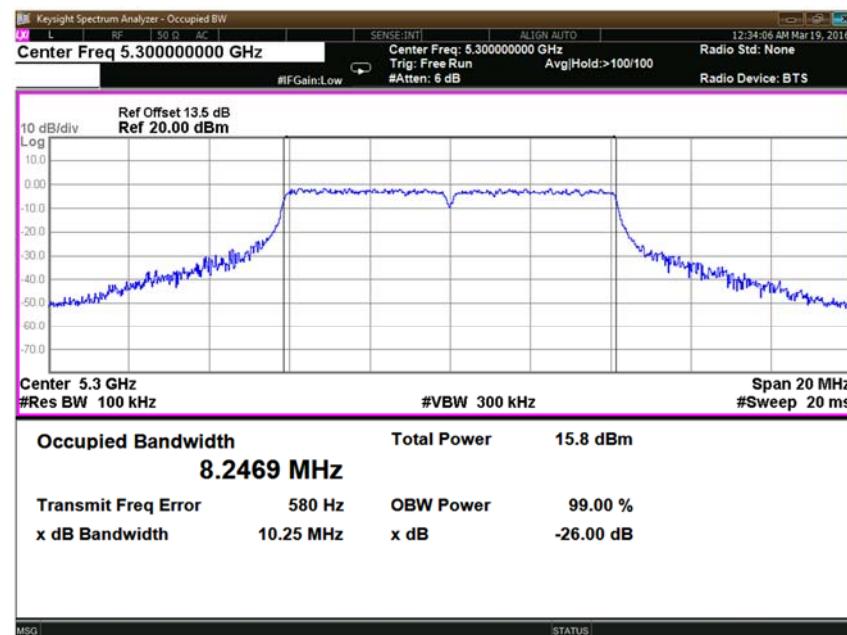


Figure 15: 10 MHz, 17 dBi, Mid channel: 26 dB bandwidth measured at Ch.1 - 5300 MHz

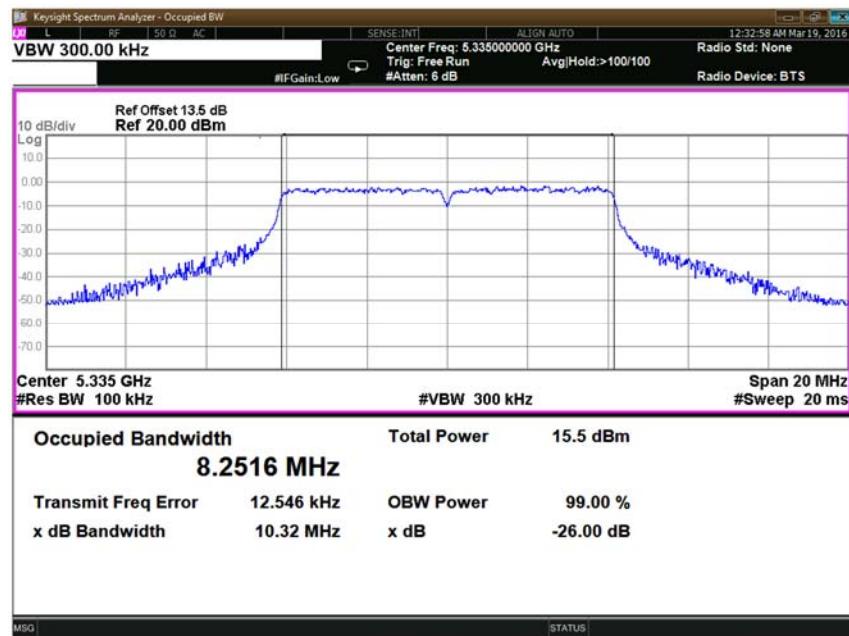


Figure 16: 10 MHz, 17 dBi, High channel: 26 dB bandwidth measured at Ch.0 - 5335 MHz

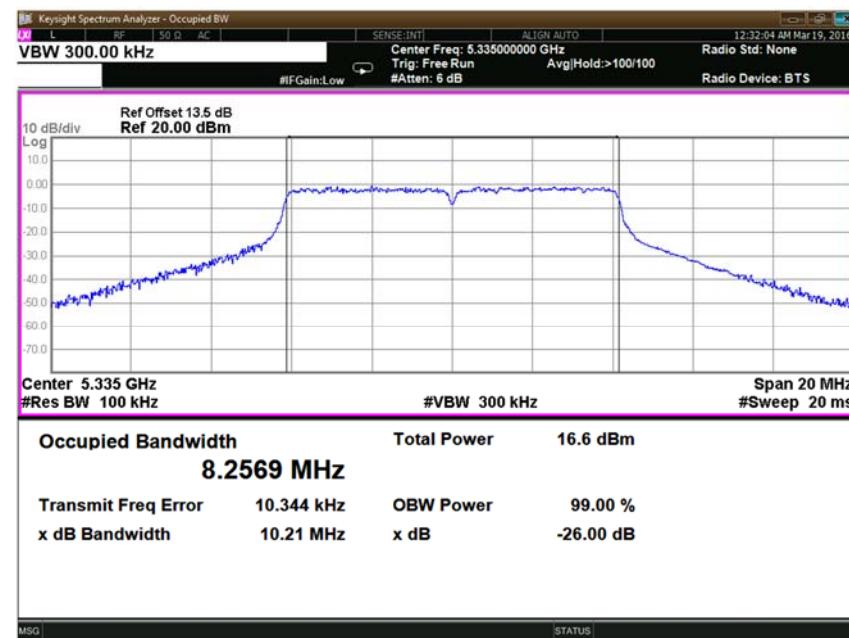


Figure 17: 10 MHz, 17 dBi, High channel: 26 dB bandwidth measured at Ch.1 - 5335 MHz

### 5.3.2.6 RESULT

The 26 dB emission bandwidth is measured for all channels in both 40 MHz & 10 MHz modulation bandwidth. Refer below table for consolidated data.

Configuration	Modulation Bandwidth (MHz)	Antenna path	Channel Frequency (MHz)	Recorded value (MHz)
17 dBi	40	Ch. 0	5280	44.22
	40	Ch. 0	5300	44.6
	40	Ch. 0	5320	43.31
	40	Ch. 1	5280	44.45
	40	Ch. 1	5300	44.65
	40	Ch. 1	5320	43.31
	10	Ch. 0	5265	9.257
	10	Ch. 0	5300	10.25
	10	Ch. 0	5335	8.251
	10	Ch. 1	5265	9.173
	10	Ch. 1	5300	10.25
	10	Ch. 1	5335	8.256

**Table 4: Result for 26 dB Bandwidth in both 40 MHz and 10 MHz modulation bandwidth**

### 5.3.3 99 % OCCUPIED CHANNEL BANDWIDTH

#### 5.3.3.1 TEST SPECIFICATION

<b>Test Standard</b>	RSS 247 Issue 1 May 2015
<b>Test Procedure</b>	789033 D2 General U-NII Test Procedures New Rule V01r01
<b>Frequency Range</b>	5250-5350 MHz
<b>Resolution Bandwidth</b>	1 MHz
<b>Video Bandwidth</b>	3 MHz
<b>Sweep Time</b>	Auto
<b>Attenuation</b>	Auto
<b>Test Mode</b>	Conducted
<b>Detector</b>	Peak
<b>Input Voltage</b>	120 V AC
<b>Input Frequency</b>	60 Hz
<b>Temperature</b>	23.0 °C
<b>Humidity</b>	55.0 %
<b>Tested By</b>	Suresh.G.N
<b>Test Date</b>	18 <sup>th</sup> Mar 2016

#### 5.3.3.2 LIMITS

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit</b>
RSS 247 Issue 1 May 2015	6.2.2(1)	5250 MHz to 5350 MHz	NA

#### 5.3.3.3 TEST SETUP



Figure 18 Typical test setup for Conducted RF Test

#### 5.3.3.4 TEST PROCEDURE

The Conducted test was performed using the Spectrum analyzer. Measurements were done as per the “**789033 D2 General U-NII Test Procedures New Rule V01r01**”. The RF output of the EUT was connected to the input port of Spectrum analyzer using an attenuator. The graph and data captured from spectrum analyzer and recorded.

### 5.3.3.5 MEASUREMENT GRAPHS / DATA

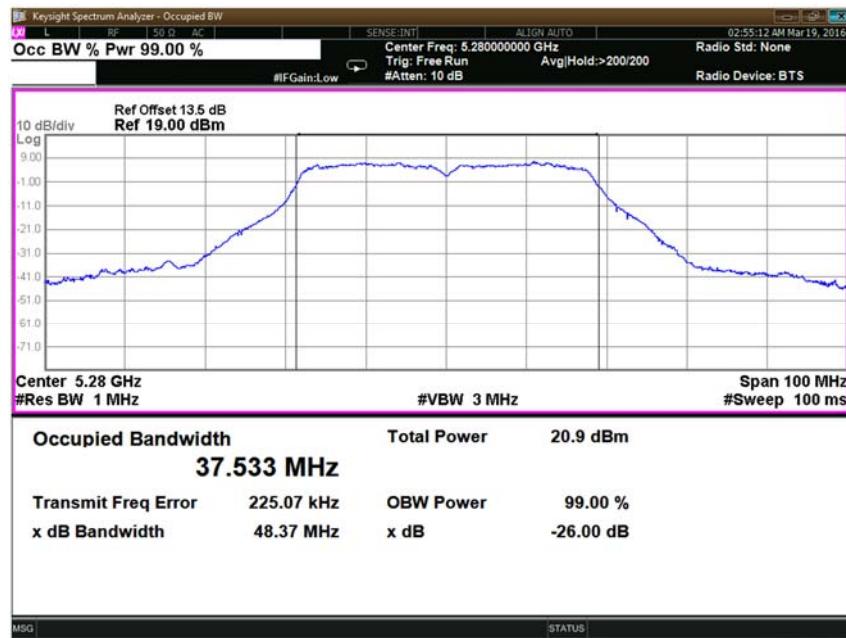


Figure 19: 40 MHz, 17 dBi, Low channel: 99% OBW measured at Ch.0 – 5280 MHz

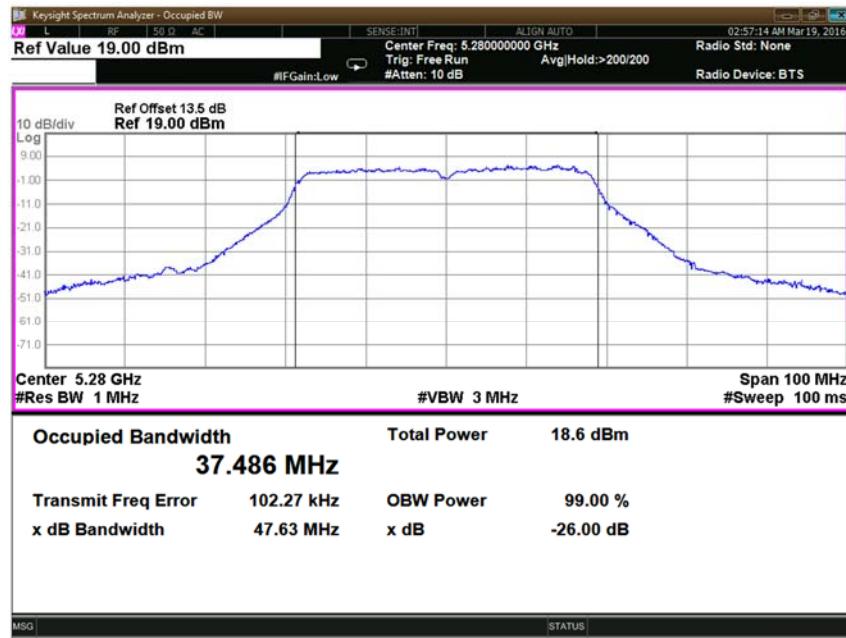


Figure 20: 40 MHz, 17 dBi, Low channel: 99% OBW measured at Ch.1 – 5280 MHz

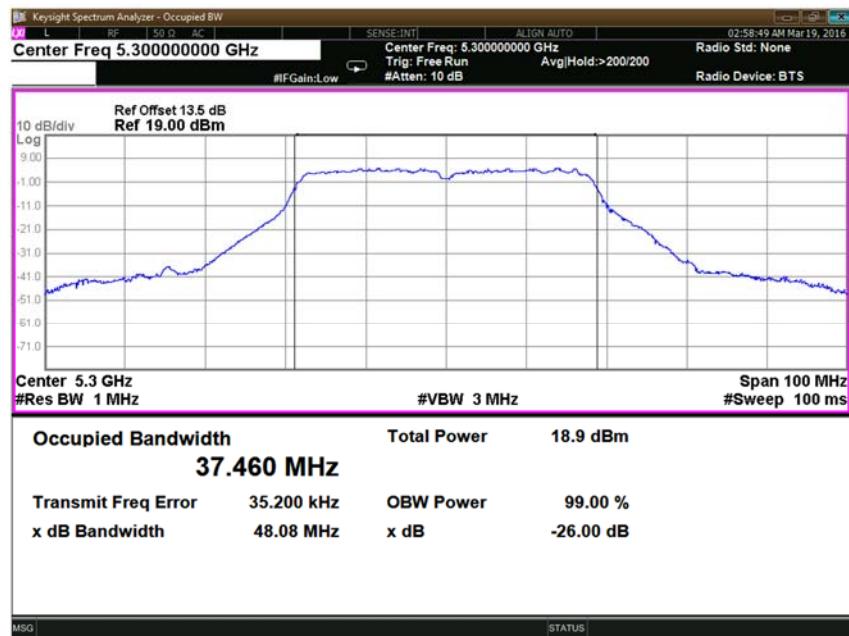


Figure 21: 40 MHz, 17 dBi, Mid channel: 99% OBW measured at Ch.0 – 5300 MHz

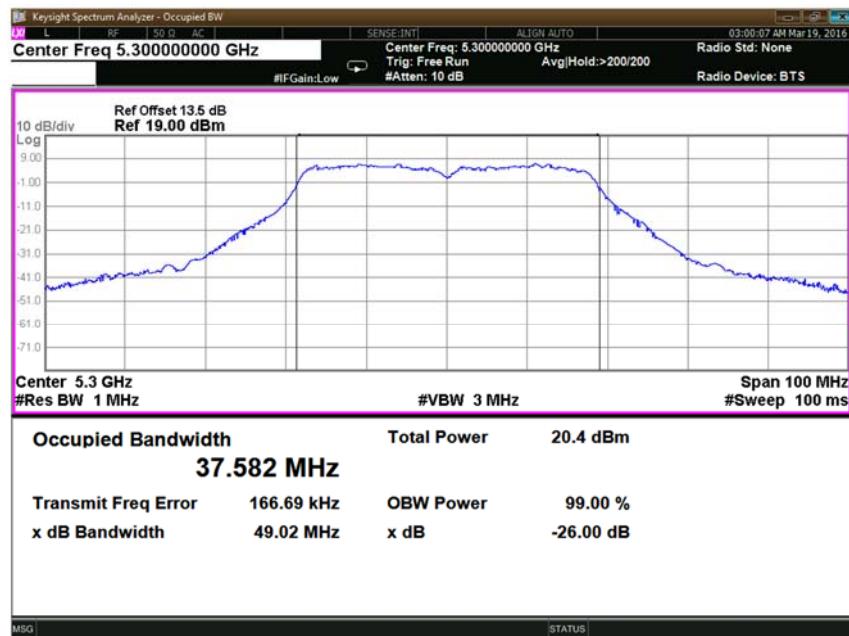


Figure 22: 40 MHz, 17 dBi, Mid channel: 99% OBW measured at Ch.1 – 5300 MHz

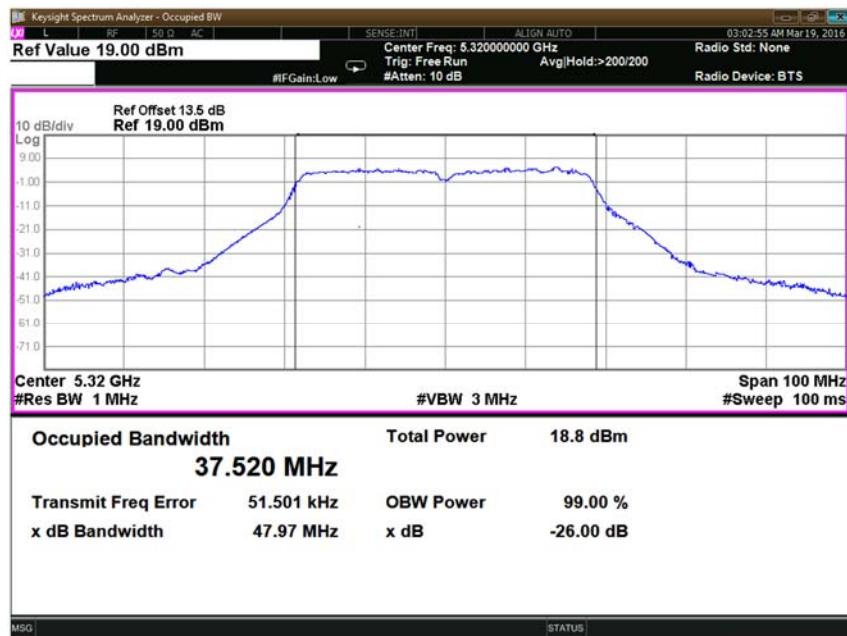


Figure 23: 40 MHz, 17 dBi, High channel: 99% OBW measured at Ch.0 – 5320 MHz

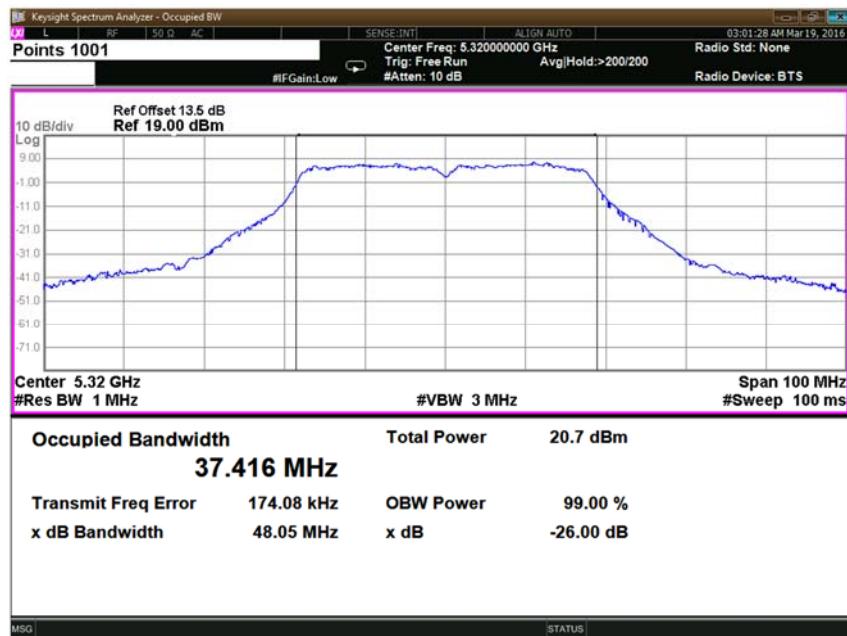


Figure 24: 40 MHz, 17 dBi, High channel: 99% OBW measured at Ch.1 – 5320 MHz

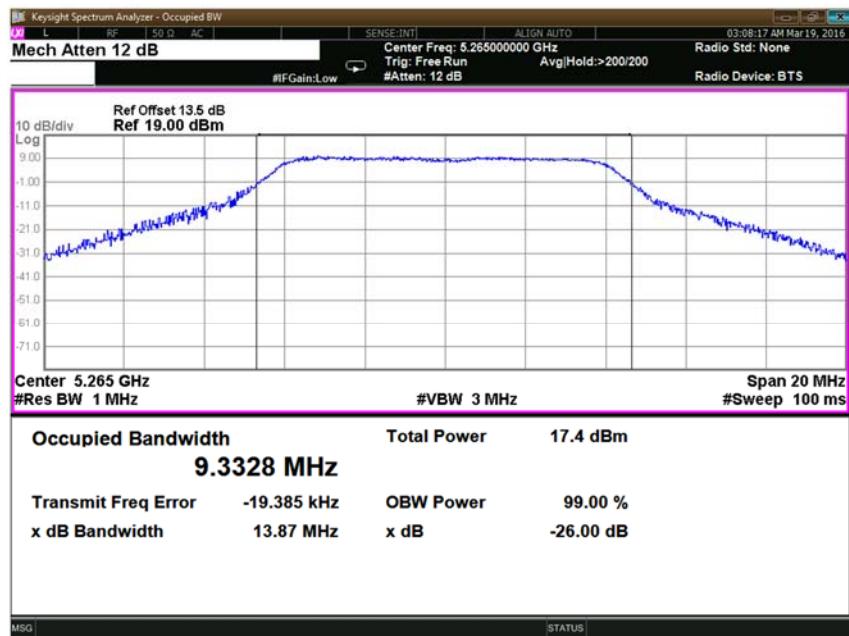


Figure 25: 10 MHz, 17 dBi, Low channel: 99% OBW measured at Ch.0 – 5265 MHz

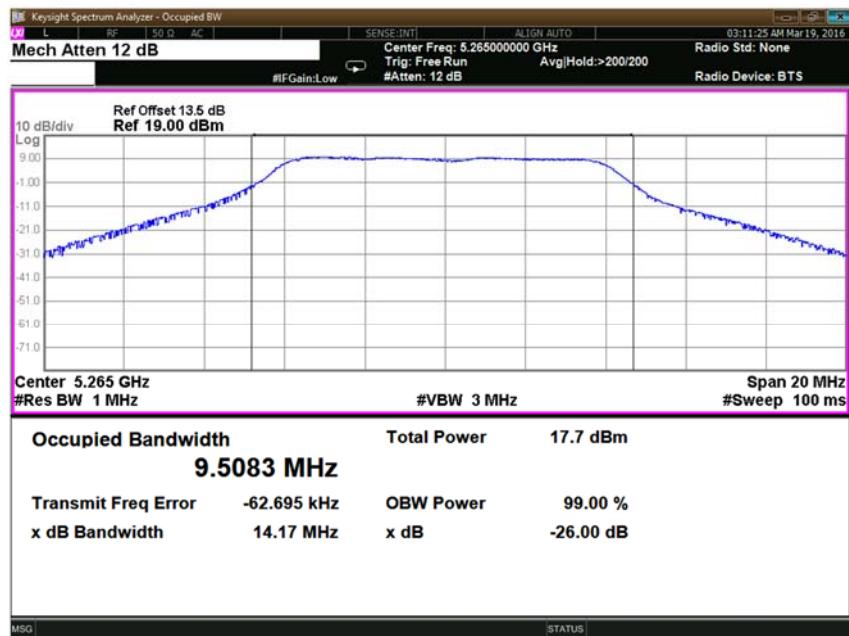


Figure 26: 10 MHz, 17 dBi, Low channel: 99% OBW measured at Ch.1 – 5265 MHz

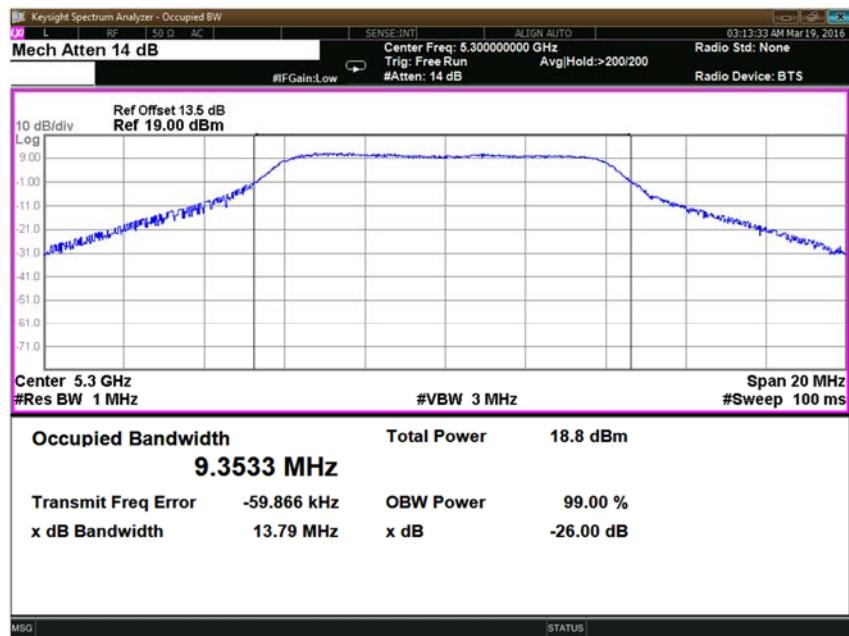


Figure 27: 10 MHz, 17 dBi, Mid channel: 99% OBW measured at Ch.0 – 5300 MHz

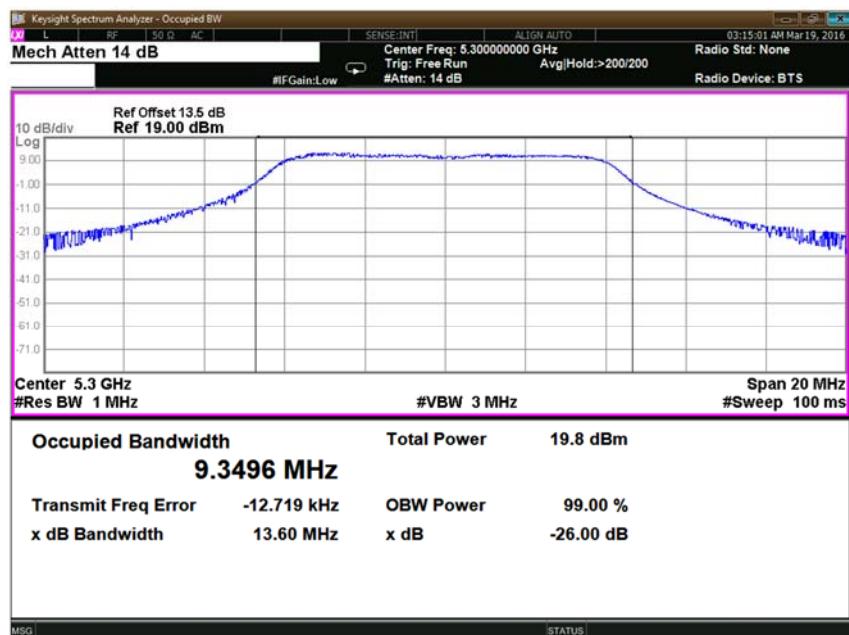


Figure 28: 10 MHz, 17 dBi, Mid channel: 99% OBW measured at Ch.1 – 5300 MHz

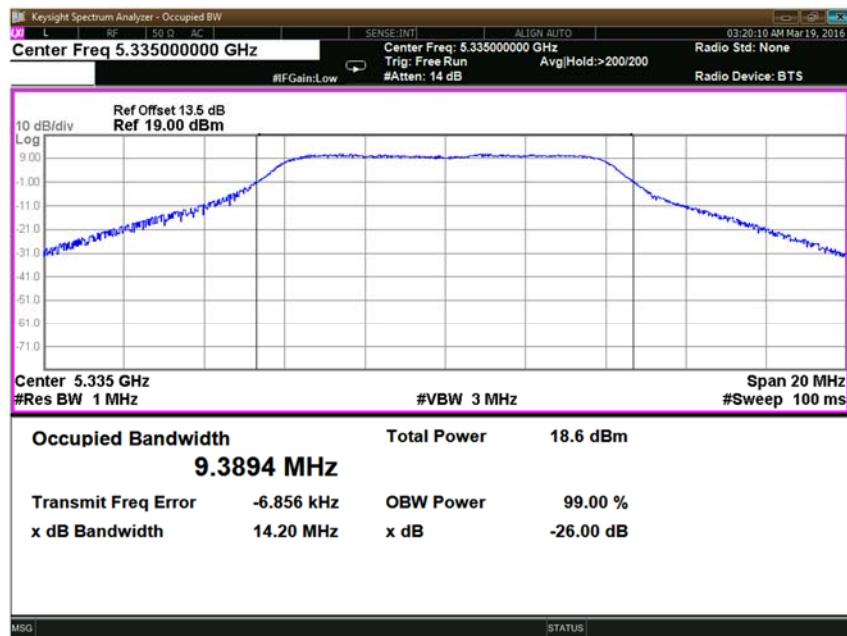


Figure 29: 10 MHz, 17 dBi, High channel: 99% OBW measured at Ch.0 – 5335 MHz

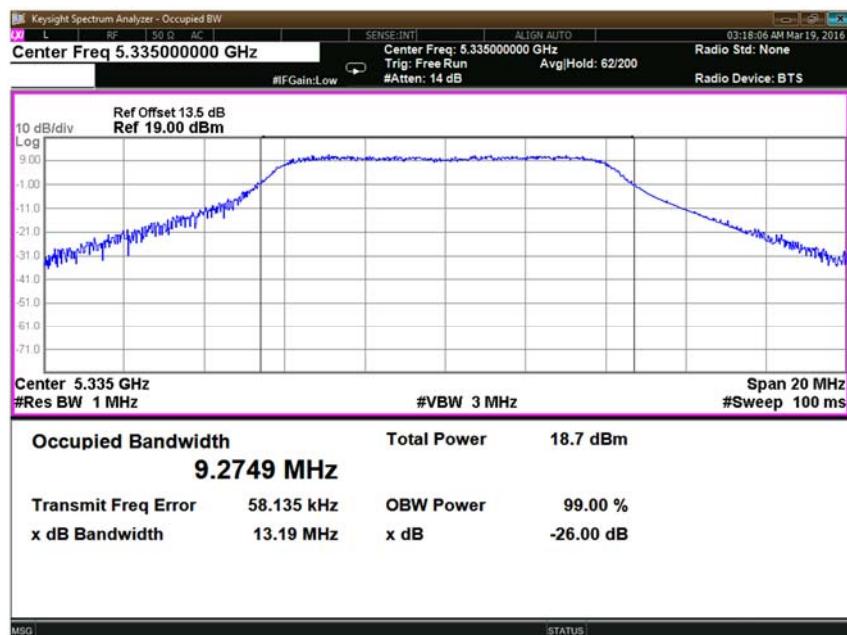


Figure 30: 10 MHz, 17 dBi, High channel: 99% OBW measured at Ch.1 – 5335 MHz

### 5.3.3.6 RESULT

The 99% Occupied channel Bandwidth for all channels in both 40 MHz & 10 MHz Modulation Bandwidths has been measured and tabulated in below table.

<b>Configuration</b>	<b>Modulation Bandwidth (MHz)</b>	<b>Antenna path</b>	<b>Channel Frequency (MHz)</b>	<b>Recorded value (MHz)</b>
17 dBi Antenna Condition	40	Ch. 0	5280	37.533
	40	Ch. 0	5300	37.46
	40	Ch. 0	5320	37.52
	40	Ch. 1	5280	37.486
	40	Ch. 1	5300	37.582
	40	Ch. 1	5320	37.41
	10	Ch. 0	5265	9.3328
	10	Ch. 0	5300	9.3533
	10	Ch. 0	5335	9.3894
	10	Ch. 1	5265	9.5083
	10	Ch. 1	5300	9.3496
	10	Ch. 1	5335	9.2749

**Table 5 Result for 99% Occupied bandwidth in both 40 MHz and 10 MHz modulation bandwidth**

## 5.3.4 MAXIMUM CONDUCTED OUTPUT POWER

### 5.3.4.1 TEST SPECIFICATION

<b>Test Standard</b>	RSS 247 Issue 1 May 2015
<b>Test Procedure</b>	789033 D2 General U-NII Test Procedures New Rule V01r01
<b>Test Mode</b>	Conducted
<b>Frequency Range</b>	5250-5350 MHz
<b>Detector</b>	Average
<b>Input Voltage</b>	120 V AC
<b>Input Frequency</b>	60 Hz
<b>Temperature</b>	23.0 °C
<b>Humidity</b>	55.0 %
<b>Tested By</b>	Suresh GN
<b>Test Date</b>	18 <sup>th</sup> Mar 2016

### 5.3.4.2 LIMITS

Standard	Reference section	Frequency range	Limit
RSS 247 Issue 1 May 2015	6.2.2(1)	5250 MHz to 5350 MHz	max conducted Tx power $\leq 23.97 \text{ dBm}$ (250 mW) max Limit (for 17 dBi antenna) : $\leq 12.97 \text{ dBm}$

### 5.3.4.3 TEST SETUP



Figure 31: Typical test setup for Conducted RF Test

### 5.3.4.4 TEST PROCEDURE

The Conducted test was performed using the power meter. Measurements were done as per Section II E 3.b (Method PM-G) of KDB “**789033 DO2 General UNII Test Procedures New Rules v01r01**”. The RF output of the EUT was connected to the input port of Power meter using an attenuator. The graph and data captured from power meter and compared with the limits specified in the standard.

### 5.3.4.5 MEASUREMENT GRAPHS / DATA

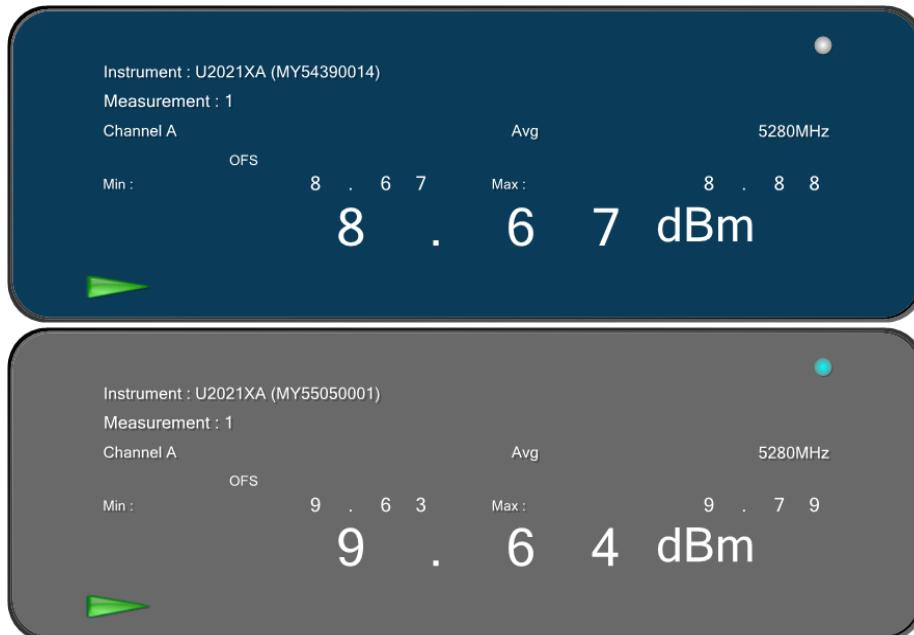


Figure 32: 40 MHz, 17 dBi, Low channel: Maximum conducted output power measured at Ch.0 & Ch.1 – 5280 MHz

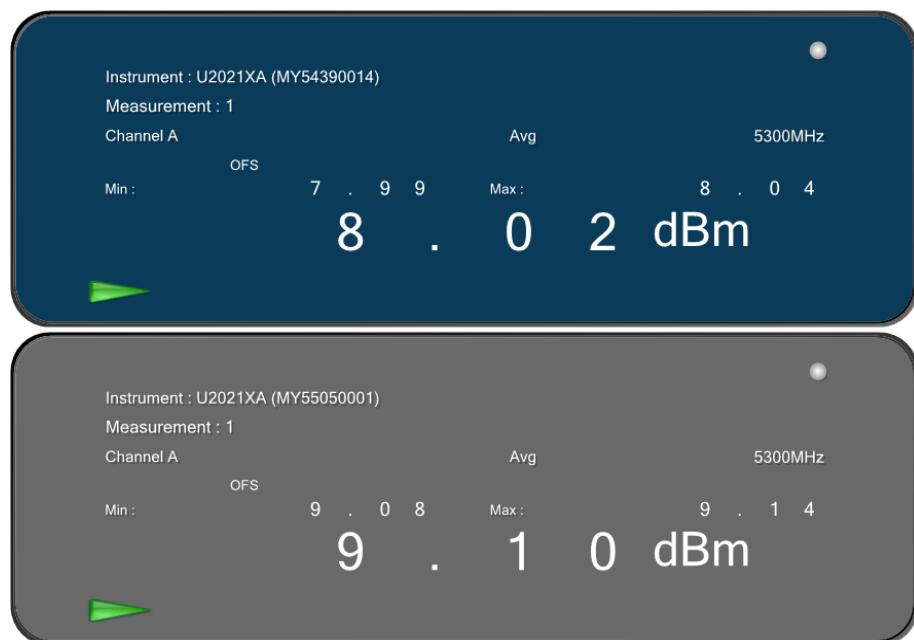


Figure 33: 40 MHz, 17 dBi, Mid channel: Maximum conducted output power measured at Ch.0 & Ch.1 – 5300 MHz



Figure 34: 40 MHz, 17 dBi, High channel: Maximum conducted output power measured at Ch.0 & Ch.1 – 5320 MHz



Figure 35: 10 MHz, 17 dBi, Low channel: Maximum conducted output power measured at Ch.0 & Ch.1 – 5265 MHz



Figure 36: 10 MHz, 17 dBi, Mid channel: Maximum conducted output power measured at Ch.0 & Ch.1 – 5300 MHz



Figure 37: 10 MHz, 17 dBi, High channel: Maximum conducted output power measured at Ch.0 & Ch.1 – 5335 MHz



Figure 38: 40 MHz, 17 dBi, Low channel: Maximum conducted output power measured at Ch.0 & Ch.1 – 5270 MHz



Figure 39: 40 MHz, 17 dBi, High channel: Maximum conducted output power measured at Ch.0 & Ch.1 – 5330 MHz



**Figure 40: 10 MHz, 17 dBi, Low channel: Maximum conducted output power measured at Ch.0 & Ch.1 – 5255 MHz**



**Figure 41: 10 MHz, 17 dBi, High channel: Maximum conducted output power measured at Ch.0 & Ch.1 – 5345 MHz**

### 5.3.4.6 RESULT

Maximum Conducted Output Power for all channels in both 40 MHz & 10 MHz modulation bandwidth is within the specified limits. Refer below table for consolidated data.

Modulation Bandwidth (MHz)	Antenna path	Channel Frequency (MHz)	Recorded value (dBm)
40	Ch. 0	5280	8.67
40	Ch. 1	5280	9.64
40	Ch. 0	5300	8.02
40	Ch. 1	5300	9.10
40	Ch. 0	5320	8.35
40	Ch. 1	5320	9.12
40	Ch. 0	5270	9.82
40	Ch. 1	5270	9.86
40	Ch. 0	5330	9.62
40	Ch. 1	5330	9.54
10	Ch. 0	5265	6.30
10	Ch. 1	5265	7.38
10	Ch. 0	5300	8.22
10	Ch. 1	5300	8.67
10	Ch. 0	5335	7.85
10	Ch. 1	5335	8.62
10	Ch. 0	5255	4.06
10	Ch. 1	5255	5.69
10	Ch. 0	5345	4.92
10	Ch. 1	5345	5.92

Table 6: Maximum conducted output power for 17 dBi configuration

Modulation Bandwidth (MHz)	Antenna path	Channel Frequency (MHz)	Consolidated Power (dBm)	Limit (dBm)	Result
40	Ch. 0 & Ch. 1	5280	12.20	12.97	PASS
40	Ch. 0 & Ch. 1	5300	11.58	12.97	PASS
40	Ch. 0 & Ch. 1	5320	11.76	12.97	PASS
40	Ch. 0 & Ch. 1	5270	12.85	12.97	PASS
40	Ch. 0 & Ch. 1	5330	12.6	12.97	PASS
10	Ch. 0 & Ch. 1	5265	9.912	12.97	PASS
10	Ch. 0 & Ch. 1	5300	11.46	12.97	PASS
10	Ch. 0 & Ch. 1	5335	11.27	12.97	PASS
10	Ch. 0 & Ch. 1	5255	7.923	12.97	PASS
10	Ch. 0 & Ch. 1	5345	8.45	12.97	PASS

**Table 7: Consolidated values across channels and final power for 17 dBi configuration**

The recorded power in dBm was converted into Watt, and then added and convert the result back to dBm  
 $dBm \text{ to } mW = \log(mW) * 10$   
 $mW \text{ to } dBm = 10^{\log(mW)/10}$

## 5.3.5 POWER SPECTRAL DENSITY

### 5.3.5.1 TEST SPECIFICATION

<b>Test Standard</b>	RSS 247 Issue 1 May 2015
<b>Test Procedure</b>	789033 D2 General U-NII Test Procedures New Rule V01r01
<b>Frequency Range</b>	5250-5350 MHz
<b>Resolution Bandwidth</b>	1 MHz
<b>Video Bandwidth</b>	3 MHz
<b>Sweep Time</b>	1 ms
<b>Attenuation</b>	Auto
<b>Test Mode</b>	Conducted
<b>Detector</b>	RMS
<b>Input Voltage</b>	120 V AC
<b>Input Frequency</b>	60 Hz
<b>Temperature</b>	23.0 °C
<b>Humidity</b>	54.0 %
<b>Tested By</b>	Suresh .G.N
<b>Test Date</b>	25 <sup>th</sup> Apr 2016

### 5.3.5.2 LIMITS

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit</b>
RSS 247 Issue 1 May 2015	6.2.2(1)	5250 MHz to 5350 MHz	≤ 11 dBm in any 1MHz band Limit (for 17 dBi antenna configuration) : ≤ 0 dBm

### 5.3.5.3 TEST SETUP



Figure 42: Typical test setup for Conducted Test

### 5.3.5.4 TEST PROCEDURE

The Conducted test was performed using the Spectrum analyzer. Measurements were done as per Section II F (PSD) of KDB ‘789033 D02 General UNII Test Procedures New Rules v01r01’. The RF output of the EUT was connected to the input port of Spectrum analyzer using an attenuator. The graph and data captured from spectrum analyzer and compared with the limits specified in the standard.

### 5.3.5.5 MEASUREMENT GRAPHS / DATA



Figure 43: 40 MHz, 17 dBi, Low channel: Power spectral density measured at Ch. 0 – 5280 MHz

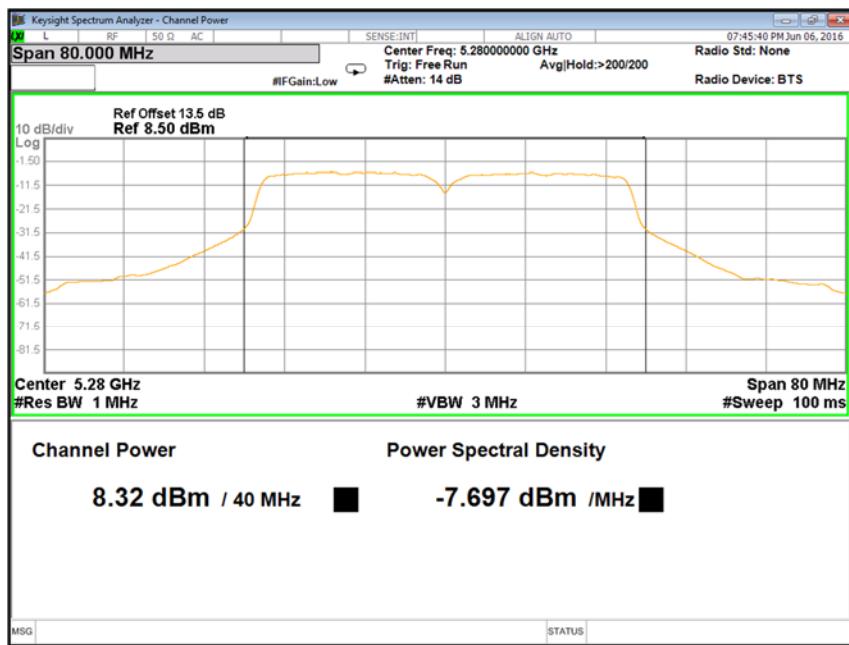


Figure 44: 40 MHz, 17 dBi, Low channel: Power spectral density measured at Ch. 1 – 5280 MHz

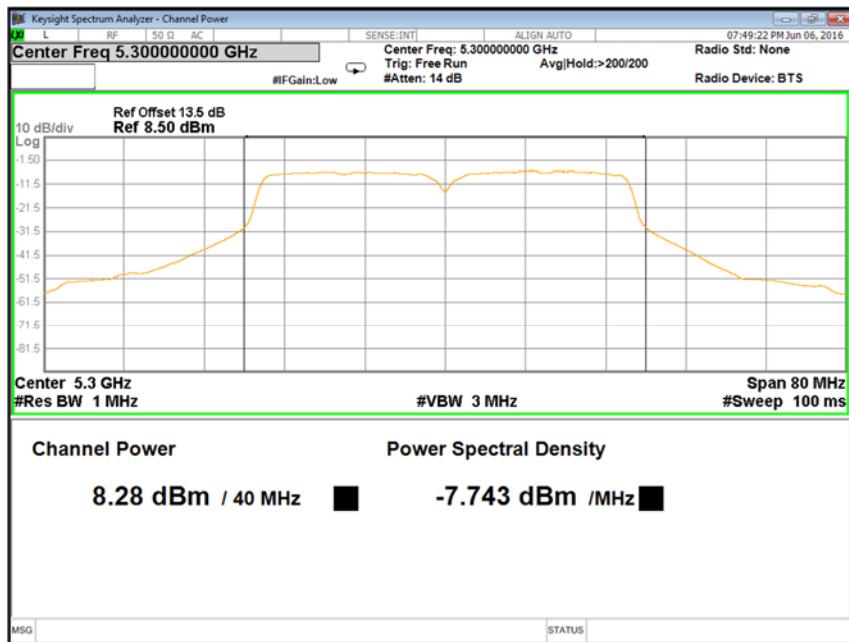


Figure 45: 40 MHz, 17 dBi, Mid channel: Power spectral density measured at Ch. 0 – 5300 MHz

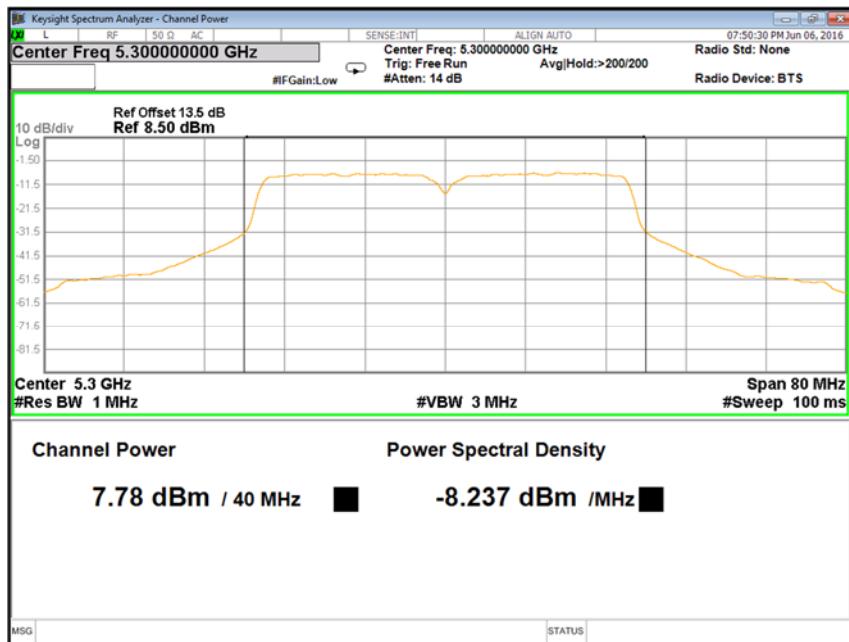


Figure 46: 40 MHz, 17 dBi, Mid channel: Power spectral density measured at Ch. 1 – 5300 MHz

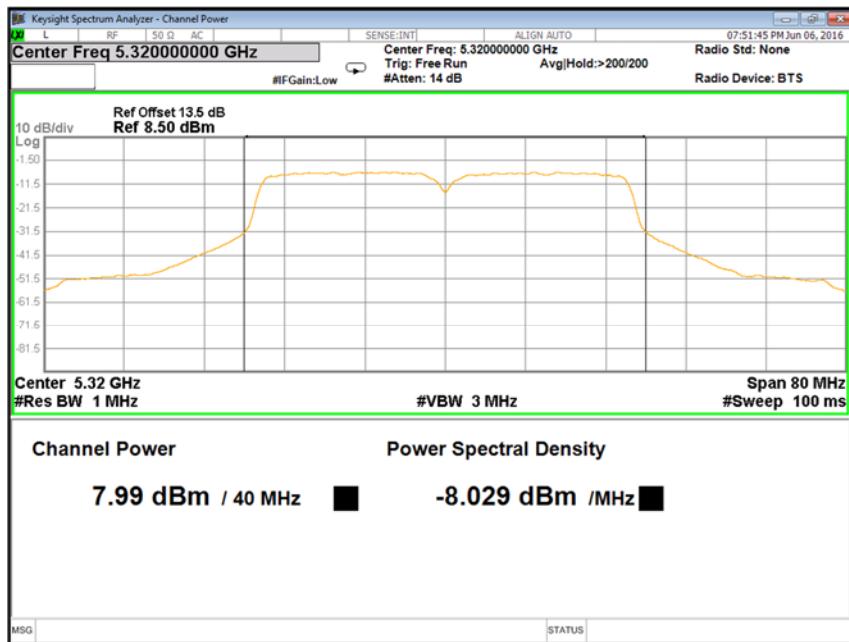


Figure 47: 40 MHz, 17 dBi, High channel: Power spectral density measured at Ch. 0 – 5320 MHz

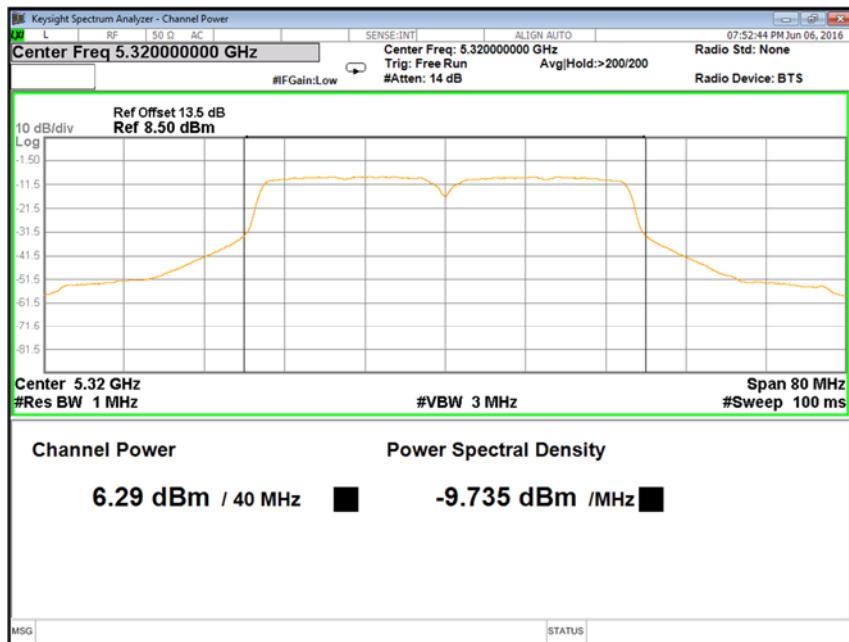


Figure 48: 40 MHz, 17 dBi, High channel: Power spectral density measured at Ch. 1 – 5320 MHz

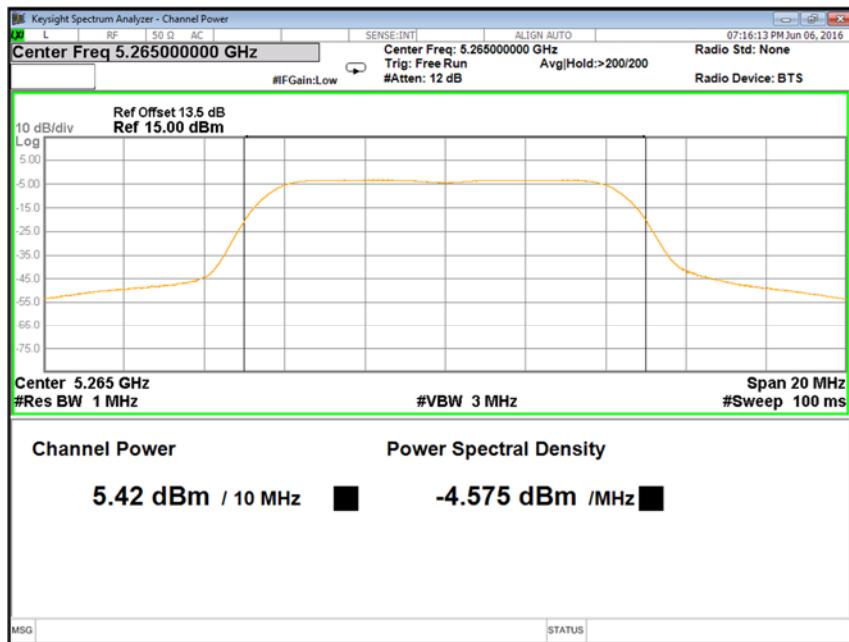


Figure 49: 10 MHz, 17 dBi, Low channel: Power spectral density measured at Ch. 0 – 5265 MHz

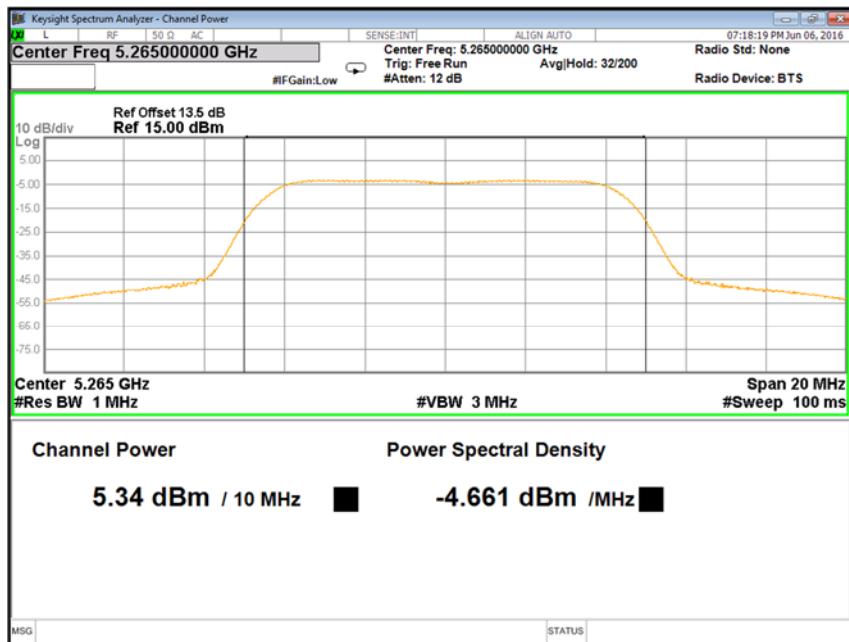


Figure 50: 10 MHz, 17 dBi, Low channel: Power spectral density measured at Ch. 1 – 5265 MHz



Figure 51: 10 MHz, 17 dBi, Mid channel: Power spectral density measured at Ch. 0– 5300 MHz

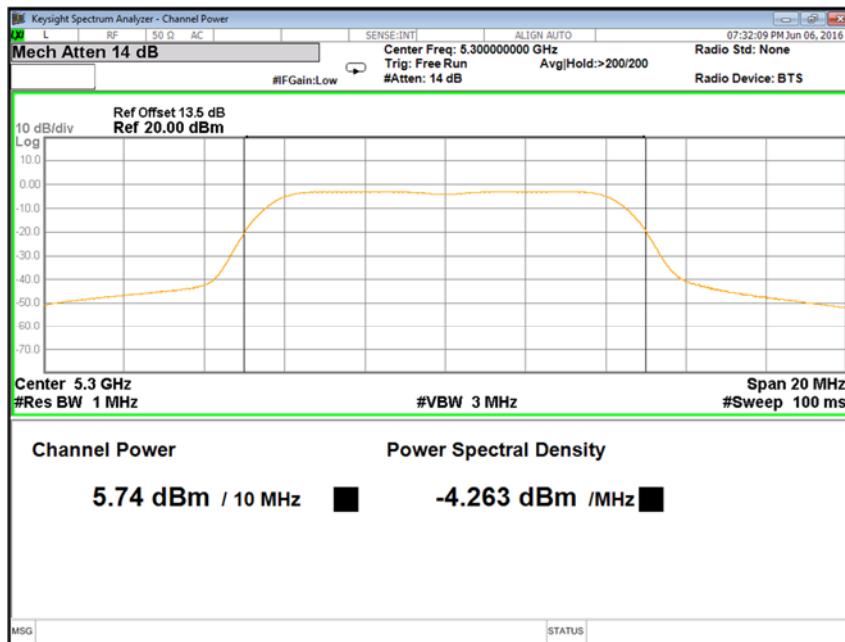


Figure 52: 10 MHz, 17 dBi, Mid channel: Power spectral density measured at Ch. 1 – 5300 MHz



Figure 53: 10 MHz, 17 dBi, High channel: Power spectral density measured at Ch. 0 – 5335 MHz

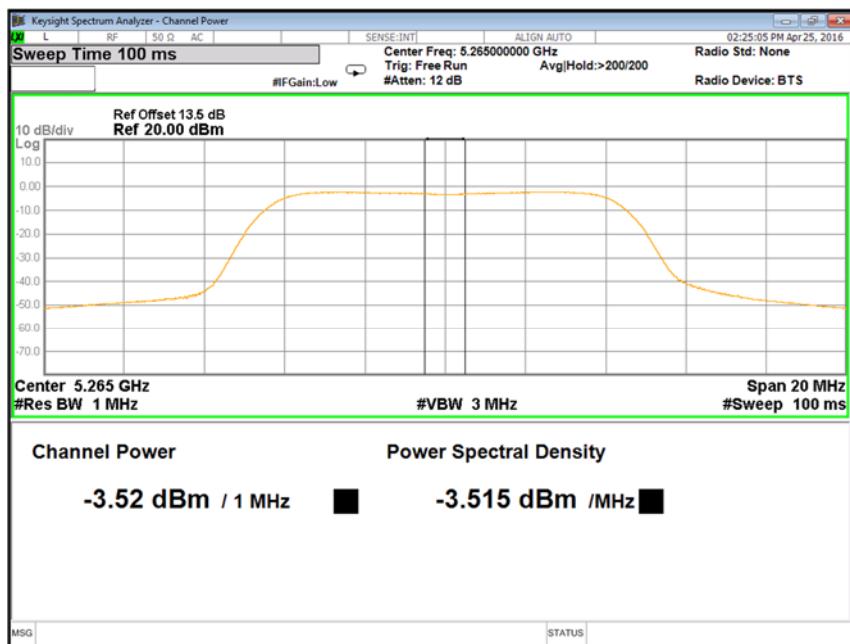


Figure 54: 10 MHz, 17 dBi, High channel: Power spectral density measured at Ch. 1 – 5335 MHz

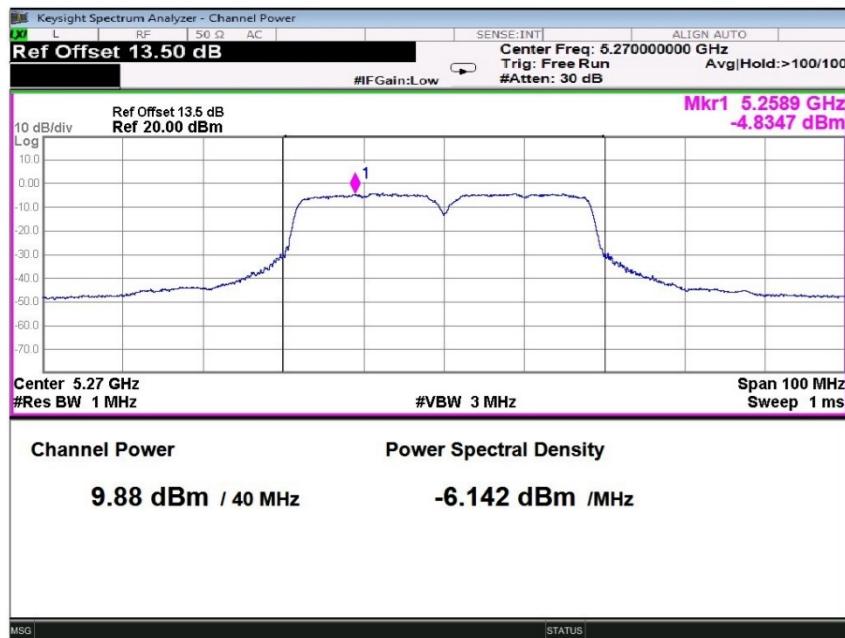


Figure 55: 40 MHz, 17 dBi, Low channel: Power spectral density measured at Ch. 0 – 5270 MHz

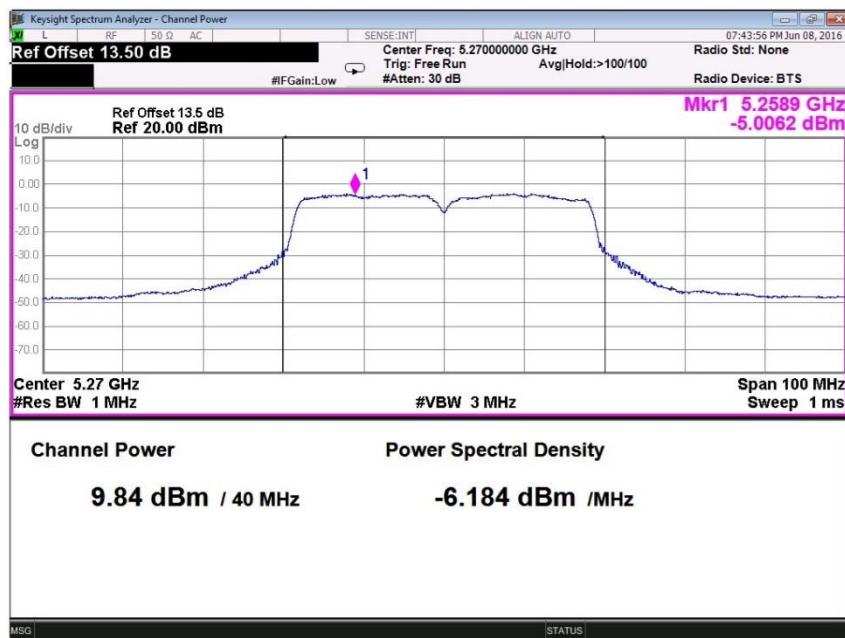


Figure 56: 40 MHz, 17 dBi, Low channel: Power spectral density measured at Ch. 1 – 5270 MHz

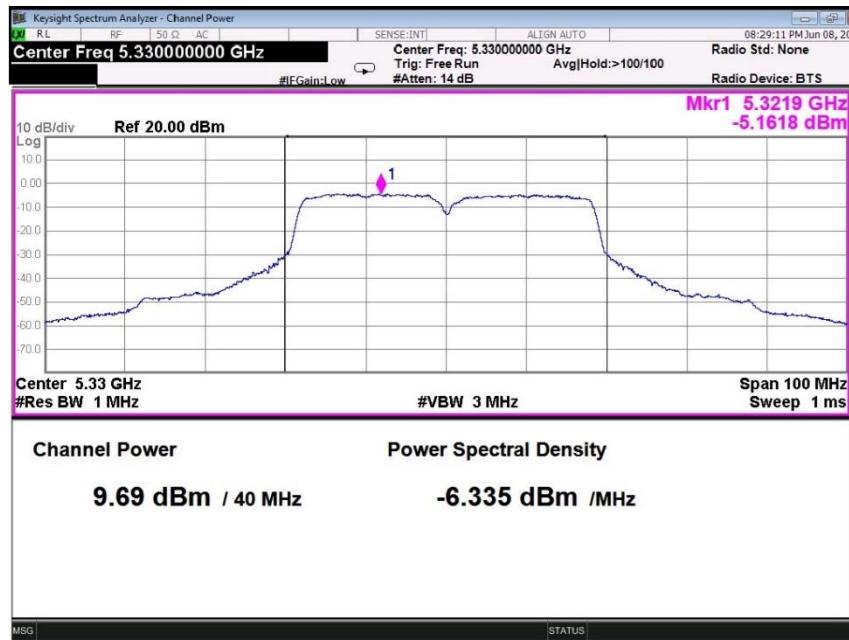


Figure 57: 40 MHz, 17 dBi, High channel: Power spectral density measured at Ch. 0 – 5330 MHz

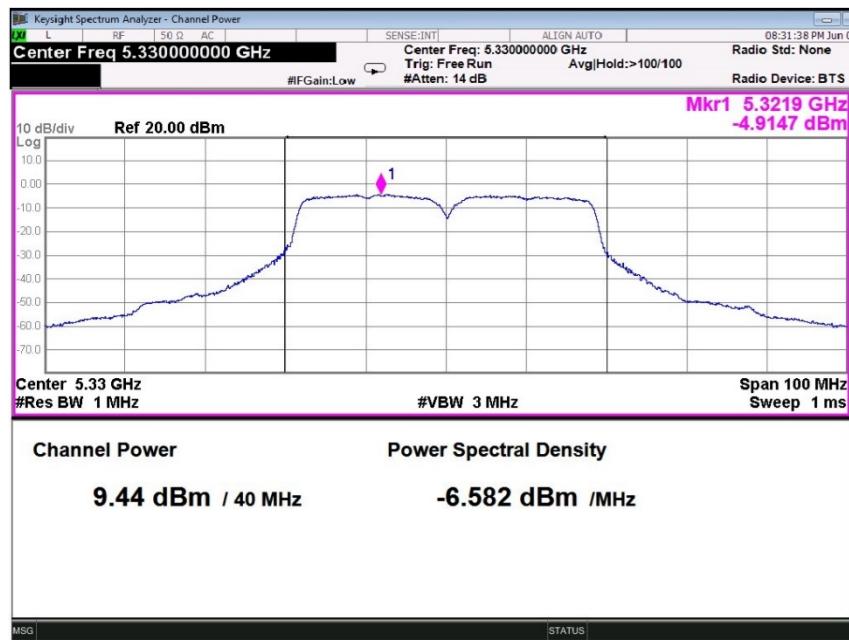


Figure 58: 40 MHz, 17 dBi, High channel: Power spectral density measured at Ch. 1 – 5330 MHz

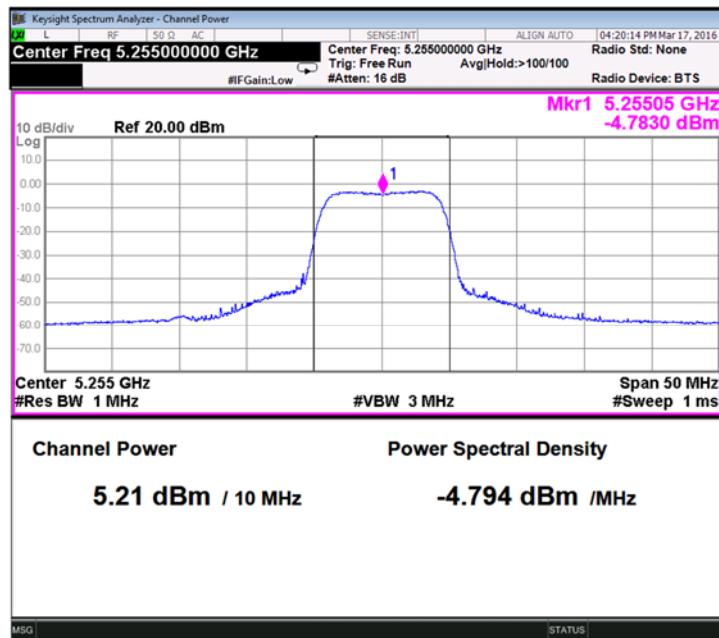


Figure 59: 10 MHz, 17 dBi, Low channel: Power spectral density measured at Ch. 0 – 5255 MHz

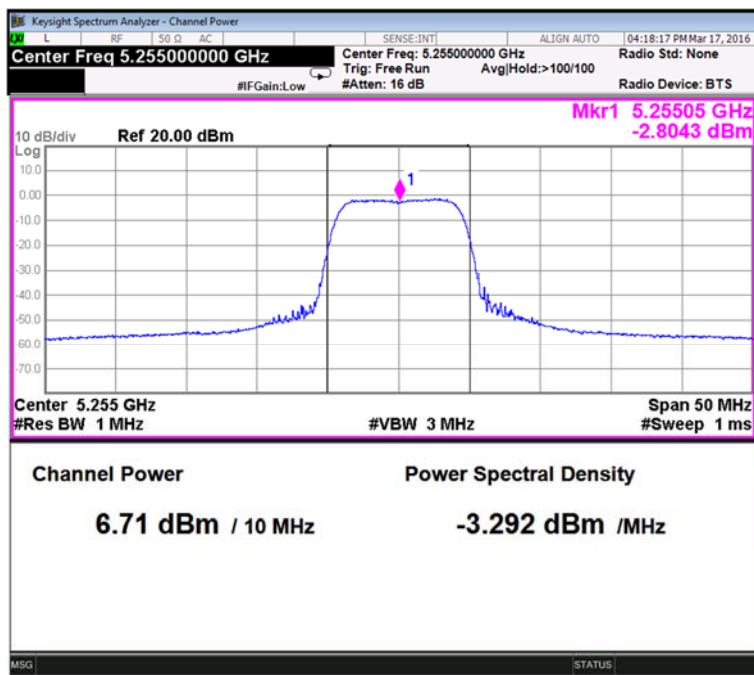


Figure 60: 10 MHz, 17 dBi, Low channel: Power spectral density measured at Ch. 1 – 5255 MHz

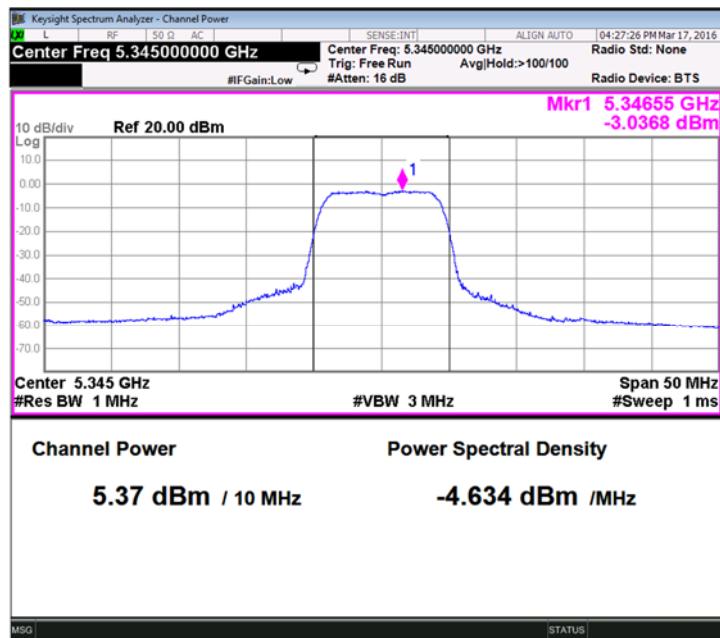


Figure 61: 10 MHz, 17 dBi, High channel: Power spectral density measured at Ch. 0 – 5345 MHz

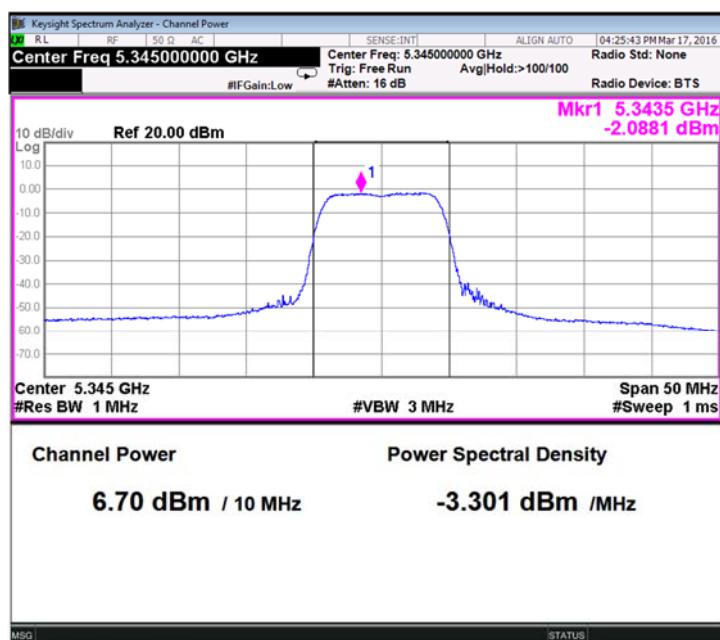


Figure 62: 10 MHz, 17 dBi, High channel: Power spectral density measured at Ch. 1 – 5345 MHz

### 5.3.5.6 RESULT

Power Spectral Density for all channels in both 40 MHz & 10 MHz Modulation Bandwidths is within the Specified limit. Refer below table for consolidated result.

Modulation Bandwidth (MHz)	Antenna path	Channel Frequency (MHz)	Recorded value (dBm/MHz)	Limit (dBm/MHz)	Result
40	Ch. 0	5280	-7.587	-3	Pass
40	Ch. 0	5300	-7.743	-3	Pass
40	Ch. 0	5320	-8.029	-3	Pass
40	Ch. 1	5280	-7.697	-3	Pass
40	Ch. 1	5300	-8.237	-3	Pass
40	Ch. 1	5320	-9.735	-3	Pass
40	Ch. 0	5270	-6.142	-3	Pass
40	Ch. 0	5330	-6.335	-3	Pass
40	Ch. 1	5270	-6.184	-3	Pass
40	Ch. 1	5330	-6.582	-3	Pass
10	Ch. 0	5265	-4.575	-3	Pass
10	Ch. 0	5300	-3.336	-3	Pass
10	Ch. 0	5335	-3.283	-3	Pass
10	Ch. 1	5265	-4.661	-3	Pass
10	Ch. 1	5300	-4.263	-3	Pass
10	Ch. 1	5335	-3.515	-3	Pass
10	Ch. 0	5255	-4.794	-3	Pass
10	Ch. 0	5345	-4.634	-3	Pass
10	Ch. 1	5255	-3.292	-3	Pass
10	Ch. 0	5345	-3.301	-3	Pass

Table 8: Result of PSD for 17 dBi configuration for both 40 MHz and 10 MHz modulation bandwidth

## 5.3.6 TRANSMITTER UNWANTED EMISSIONS (CONDUCTED)

### 5.3.6.1 TEST SPECIFICATION

<b>Test Standard</b>	RSS 247 Issue 1 May 2015			
<b>Test Procedure</b>	ANSI C63.10-2013			
<b>Frequency Range</b>	9 kHz - 150 kHz	150 kHz -30 MHz	30 MHz-1 GHz	1 GHz – 40 GHz
<b>Resolution Bandwidth</b>	200 Hz	9 kHz	120 kHz	1 MHz
<b>Video Bandwidth</b>	1 kHz	30 kHz	300 kHz	3 MHz
<b>Sweep Time</b>	Auto	Auto	Auto	Auto
<b>Detector</b>	Peak	Peak	Peak	Peak & Average
<b>Attenuation</b>	Auto			
<b>Test Mode</b>	Conducted			
<b>Input Voltage</b>	120 V AC			
<b>Input Frequency</b>	60 Hz			
<b>Temperature</b>	23.0 °C			
<b>Humidity</b>	54.0 %			
<b>Tested By</b>	Suresh.G.N			
<b>Test Date</b>	26 <sup>th</sup> Apr 2016			

### 5.3.6.2 LIMITS

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit EIRP (dBm/MHz)</b>
RSS 247 Issue 1 May 2015	6.2.2(2)	Outside 5470-5725 MHz	-27

Table 9: Tx Unwanted emission Limit

<b>Standard</b>	<b>Reference section</b>	<b>Frequency range</b>	<b>Limit (dB<math>\mu</math>V/m)</b>
RSS GEN-Issue 4 Nov 2014	8.9 and 8.10	9 kHz to 490 kHz 490 kHz to 1.705 MHz 1.705 MHz to 30 MHz	128.5194 to 93.8003* 73.8003 to 62.9697* 69.5429

Table 10: General Field strength limit below 30 MHz

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) as per Section 5.209</b>
RSS GEN-Issue 4 Nov 2014	8.9 and 8.10	30 MHz to 88 MHz 88 MHz to 216 MHz 216 MHz to 960 MHz 960 MHz to 40 GHz	40 43.52 46.02 53.98

Table 11: General Field strength limit above 30 MHz

Above table specifies limit with Average detector above 1 GHz. 73.98 dB $\mu$ V/m is considered as the limit when Peak detector is employed for the measurements above 1 GHz.

### 5.3.6.3 TEST SETUP



Figure 63: Typical test setup for Conducted test

### 5.3.6.4 TEST PROCEDURE

The Conducted test was performed using the Spectrum analyzer/EMI receiver. Measurements were done as per Section II G.0 of KDB “**789033 DO2 General UNII Test Procedure New Rules v01r01**”. The RF output of the EUT was connected to the input port of Spectrum analyzer/EMI receiver using an attenuator. The graph and data captured from spectrum analyzer and performed required calculations to attain the Electric Field value and compared with the limits specified in the standard.

In the frequency range 9 kHz to 1 GHz, the measurement was performed with peak detector. In the frequency range 1 GHz to 40 GHz, measurement was performed employing both peak & average detector as specified in the standard. Detectors were selected based on FCC KDB document.

Peak search option was used to capture the frequency with maximum amplitude in the respective bands and final calculations have been performed on these frequencies to show compliance with the limits specified.

### 5.3.6.5 MEASUREMENT GRAPHS / DATA

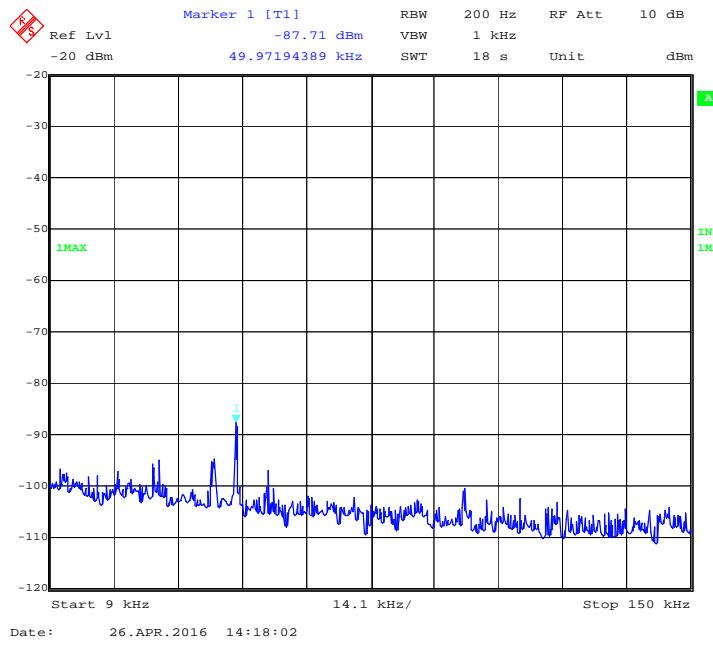


Figure 64: 40 MHz, 17 dBi, Low channel: Peak emission from 9 kHz to 150 kHz at Ch. 0 – 5280 MHz

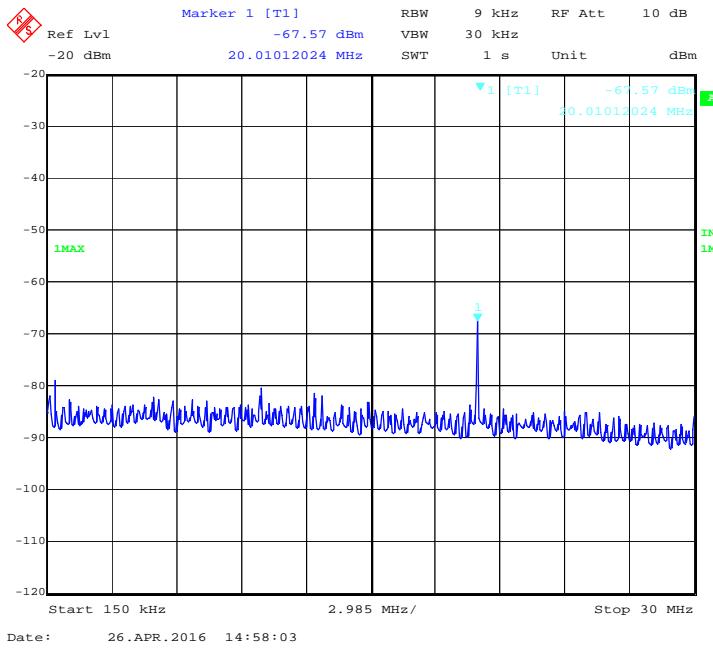
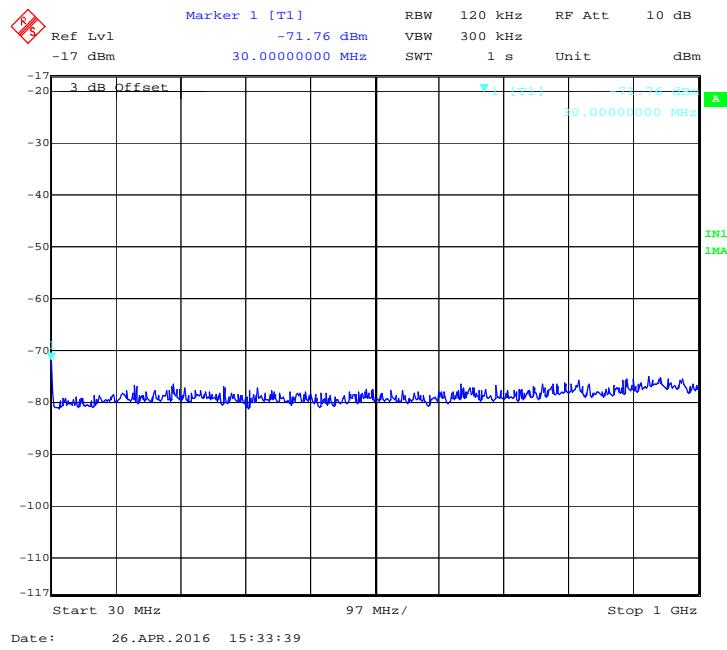
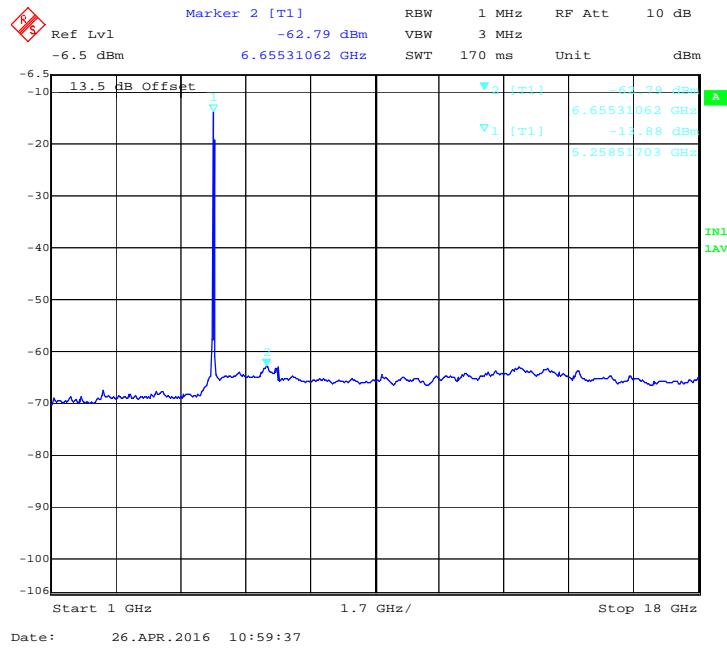


Figure 65: 40 MHz, 17 dBi, Low channel: Peak emission from 150 kHz to 30 MHz at Ch. 0 – 5280 MHz



**Figure 66: 40 MHz, 17 dBi, Low channel: Peak emission from 30 MHz to 1 GHz at Ch. 0 –5280 MHz**



**Figure 67: 40 MHz, 17 dBi, Low channel: Average emission from 1 GHz to 18 GHz at Ch. 0 –5280 MHz**

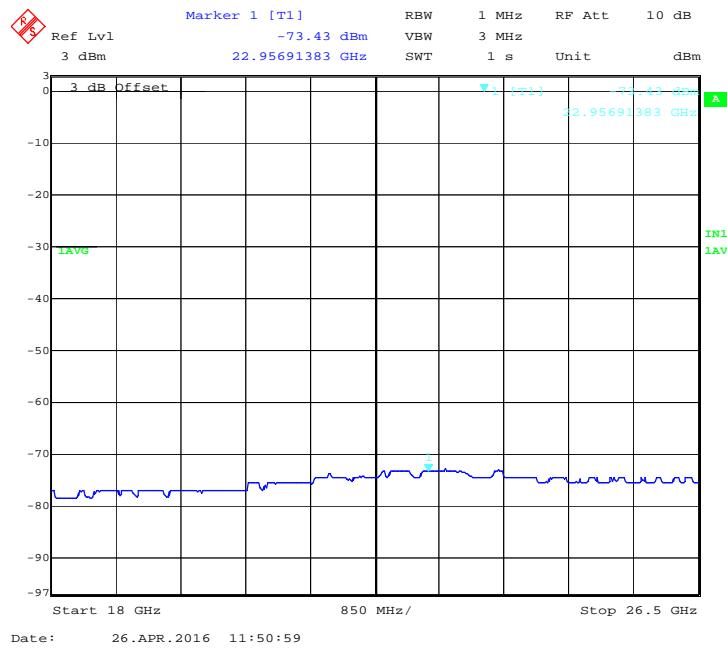


Figure 68: 40 MHz, 17 dBi, Low channel: Average emission from 18 GHz to 26.5 GHz at Ch. 0 –5280 MHz

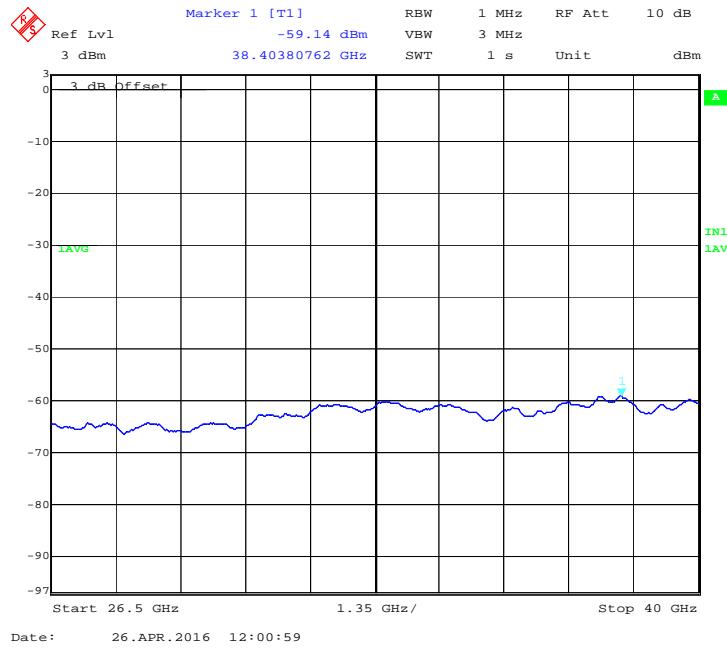


Figure 69: 40 MHz, 17 dBi, Low channel: Average emission from 26.5 GHz to 40 GHz at Ch. 0 –5280 MHz

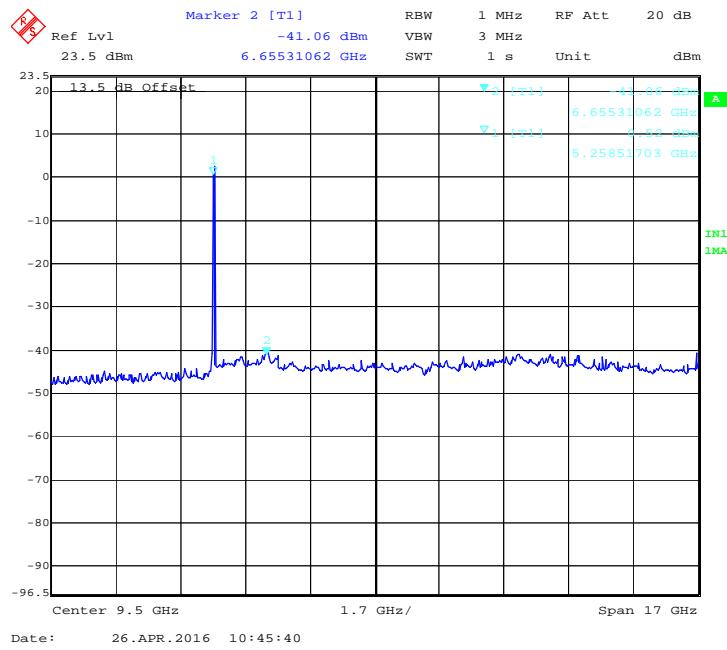


Figure 70: 40 MHz, 17 dBi, Low channel: Peak emission from 1 GHz to 18 GHz at Ch. 0 –5280 MHz

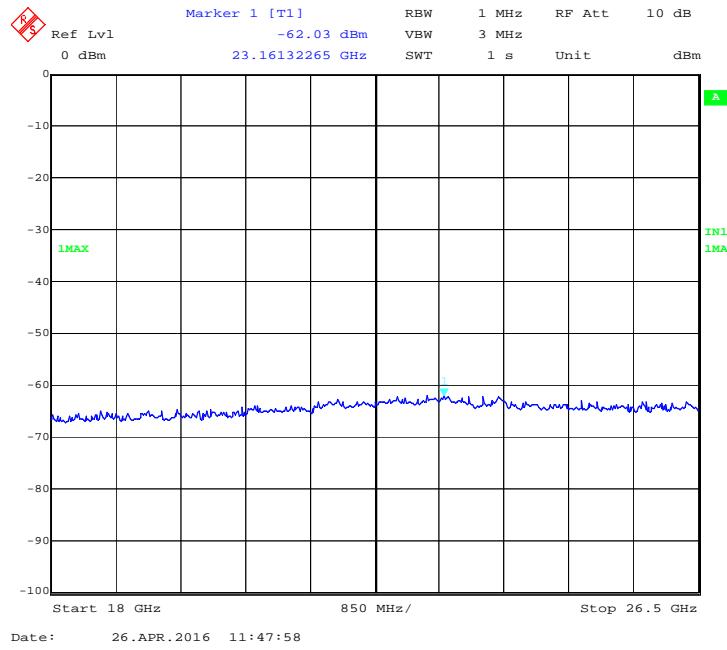
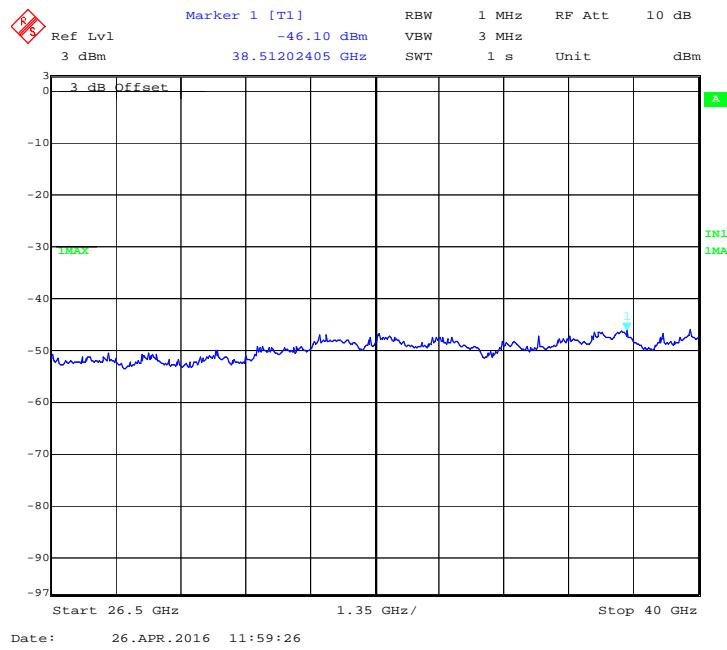
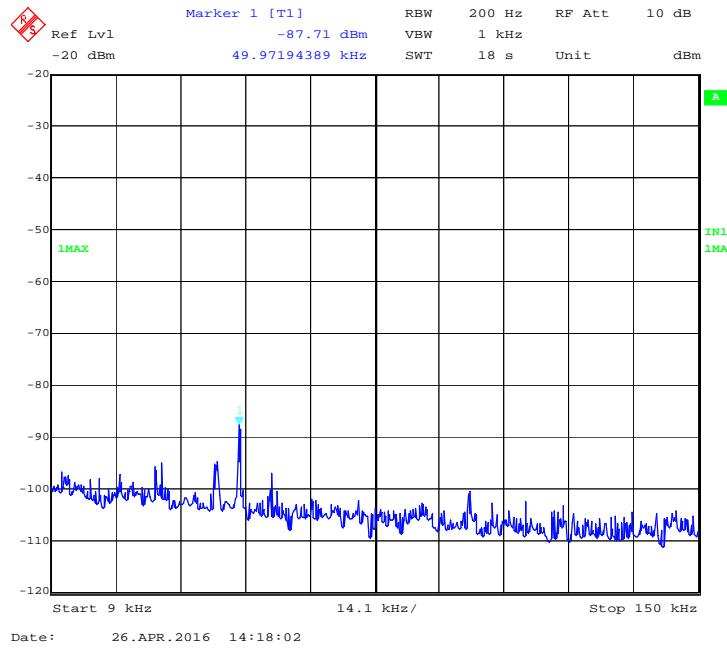


Figure 71: 40 MHz, 17 dBi, Low channel: Peak emission from 18 GHz to 26.5 GHz at Ch. 0 –5280 MHz



**Figure 72: 40 MHz, 17 dBi, Low channel: Peak emission from 26.5 GHz to 40 GHz at Ch. 0 –5280 MHz**



**Figure 73: 40 MHz, 17 dBi, Low channel: Peak emission from 9 kHz to 150 kHz at Ch. 1 –5280 MHz**