

FCC:BV5SMALLENGINE

EMI - TEST REPORT

- FCC Part 15.407 and RSS210 Annex 9 -



Test Report No. :	T34325-02-01HS	08 June 2011 Date of issue
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Type / Model Name : Small Engine

Product Description : WLAN-Module with Host

Applicant : Bang & Olufsen A/S

Address : Peter-Bangs-Vej 15

7600 STRUER, DENMARK

Manufacturer : Bang & Olufsen A/S

Address : Peter-Bangs-Vej 15

7600 STRUER, DENMARK

Licence holder : Bang & Olufsen A/S

Address : Peter-Bangs-Vej 15

7600 STRUER, DENMARK

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
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The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test results
without the written permission of the test laboratory.

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ATTACHMENT A, T34325

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September, 2010)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart B - Unintentional Radiators (September, 2010)

Part 15, Subpart B, Section 15.107	AC Line conducted emissions
Part 15, Subpart B, Section 15.109	Radiated emissions, general requirements

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September, 2010)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.212	Modular transmitters

FCC Rules and Regulations Part 15, Subpart E – Unlicensed National Information Infrastructure Devices (September, 2010)

Part 15, Subpart E, Section 15.407	Operation within the bands 5.15 - 5.25 GHz, 5.25 - 5.35 GHz, 5.47 - 5.725 GHz and 5.725 - 5.825 GHz
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FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: portable device

OET Bulletin 65, 65A, 65B, 65C Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

ET Docket No. 03-122, FCC 06-96	Released June 30, 2006, Memorandum Opinion and Order concerning DFS
ANSI C63.4: 2003	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
CISPR 16-4-2: 2003	Uncertainty in EMC measurement
CISPR 22: 2005	Information technology equipment
EN 55022: 2006	
DA 02-2138	Measurement procedure updated for peak transmission power in the UNII bands

2 SUMMARY

2.1 Test result summery

WLAN devices using digital modulation:

Operating in the 5150 MHz - 5350 MHz and 5475 MHz – 5725 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS Gen, 7.2.4.	AC power line conducted emissions	passed
15.407(a)		26 dB EBW	passed
15.407(a)	RSS210, A9.2	Conducted output power and PSD	passed
15.407(a)(6)		Peak excursion	passed
15.407(b)	RSS210, A9.2	Undesirable emissions	passed
15.205(a)	RSS-Gen, 7.2.2	Emissions in restricted bands	passed
15.407(g)	RSS-Gen, 7.2.6	Frequency stability	passed
15.407(f)	RSS210, A9.2	Maximum permissible exposure (MPE)	passed
15.407(h)(1)	RSS210, A9.2	TPC	not applicable
15.407(a)	RSS210, A9.2	Antenna requirement	passed
OET Bulletin 65	RSS102, 3.2	Co-location, Co-transmission	passed
15.111(a)	RSS-Gen, 6.2	Receiver spurious emissions, conducted	not applicable
15.109(a)	RSS-Gen, 6.1	Receiver spurious emissions, radiated	passed
	RSS210, A9.2	99% EBW	passed

The mentioned RSS Rule Parts in the above table are related to:

RSS Gen, Issue 3, December 2010

RSS 210, Issue 8, December 2010

RSS 102, Issue 4, March 2010

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GENERAL REMARKS:

The EUT “small engine” is a WLAN module with host PCB. For the compliance testing the “small engine” is implemented in a reference integration BeoSound5-Encore to provide with the necessary operating voltages and control interfaces.

Available Features:

The “small engine” is compatible with 802.11n technology. It is operating in the 5 GHz frequency bands. The operation in the 2.4 GHz band is disabled by firmware. The EUT can operate as client only. The client has no radar detection and no TPC. The EUT has no ad hoc modes. The output power is not accessible by the user. The EUT use the MIMO function with multiple antennas without beam forming. In legacy mode only one antenna is active, this means a transmission of completely uncorrelated signals.

- 802.11a mode 5.150 GHz – 5.250 GHz
 5.250 GHz – 5.350 GHz
 5.470 GHz – 5.725 GHz
- 802.11n mode 5.150 GHz – 5.250 GHz
 5.250 GHz – 5.350 GHz
 5.470 GHz – 5.725 GHz

The module use OFDM modulation and is capable to provide following data rates:

- 802.11a 54, 48, 36, 24, 18, 12, 9, 6 Mbps
- 802.11n HT20, MCS 0 – 7
- 802.11n HT40, MCS 0 – 15

HT20

MCS Index	Modulation	R	$N_{BPS}CS(i_{SS})$	N_{SD}	N_{SP}	N_{CBPS}	N_{DBPS}	Data rate (Mb/s)	
								800 ns GI	400 ns GI (see NOTE)
0	BPSK	1/2	1	52	4	52	26	6.5	7.2
1	QPSK	1/2	2	52	4	104	52	13.0	14.4
2	QPSK	3/4	2	52	4	104	78	19.5	21.7
3	16-QAM	1/2	4	52	4	208	104	26.0	28.9
4	16-QAM	3/4	4	52	4	208	156	39.0	43.3
5	64-QAM	2/3	6	52	4	312	208	52.0	57.8
6	64-QAM	3/4	6	52	4	312	234	58.5	65.0
7	64-QAM	5/6	6	52	4	312	260	65.0	72.2

NOTE—Support of 400 ns GI is optional on transmit and receive.

HT40

MCS Index	Modulation	R	$N_{BPS}CS(i_{SS})$	N_{SD}	N_{SP}	N_{CBPS}	N_{DBPS}	Data rate (Mb/s)	
								800 ns GI	400 ns GI
0	BPSK	1/2	1	108	6	108	54	13.5	15.0
1	QPSK	1/2	2	108	6	216	108	27.0	30.0
2	QPSK	3/4	2	108	6	216	162	40.5	45.0
3	16-QAM	1/2	4	108	6	432	216	54.0	60.0
4	16-QAM	3/4	4	108	6	432	324	81.0	90.0
5	64-QAM	2/3	6	108	6	648	432	108.0	120.0
6	64-QAM	3/4	6	108	6	648	486	121.5	135.0
7	64-QAM	5/6	6	108	6	648	540	135.0	150.0

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MCS Index	Modulation	R	$N_{BPS\text{CS}}(i_{SS})$	N_{SD}	N_{SP}	N_{CBPS}	N_{DBPS}	Data rate (Mb/s)	
								800 ns GI	400 ns GI
8	BPSK	1/2	1	108	6	216	108	27.0	30.0
9	QPSK	1/2	2	108	6	432	216	54.0	60.0
10	QPSK	3/4	2	108	6	432	324	81.0	90.0
11	16-QAM	1/2	4	108	6	864	432	108.0	120.0
12	16-QAM	3/4	4	108	6	864	648	162.0	180.0
13	64-QAM	2/3	6	108	6	1296	864	216.0	240.0
14	64-QAM	3/4	6	108	6	1296	972	243.0	270.0
15	64-QAM	5/6	6	108	6	1296	1080	270.0	300.0

Symbol	Explanation
N_{SS}	Number of spatial streams
R	Coding rate
$N_{BPS\text{C}}$	Number of coded bits per single carrier (total across spatial streams)
$N_{BPS\text{C}}(i_{SS})$	Number of coded bits per single carrier for each spatial stream, $i_{SS} = 1, \dots, N_{SS}$
N_{SD}	Number of complex data numbers per spatial stream per OFDM symbol
N_{SP}	Number of pilot values per OFDM symbol
N_{CBPS}	Number of coded bits per OFDM symbol
N_{DBPS}	Number of data bits per OFDM symbol
N_{ES}	Number of BCC encoders for the DATA field
N_{TBPS}	Total bits per subcarrier

Channel plan:

HT20 mode:

Channel	Frequency
36	5180
40	5200
44	5220
48	5240
52	5260
56	5280
60	5300
64	5320
100	5500
104	5520
108	5540
112	5560
116	5580
120	5600
124	5620
128	5640
132	5660
136	5680
140	5700

HT40 mode:

Channel	Frequency
38	5190
46	5230
54	5270
62	5310
102	5510
110	5550
134	5670

The following integrated antenna is used with the module:

Number	Characteristic	Name	Connector	Frequency band	Gain
1	MIMO	ASSY PN: 1551359	U.FL	4.9 – 5.875 GHz	5 dBi

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FINAL ASSESSMENT:

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 06 October 2010

Testing concluded on : 08 June 2011

Checked by:

Tested by:

Thomas Weise
Dipl. Ing.(FH)
Laboratory Manager

Hermann Smetana
Dipl.-Ing.(FH)
Radio Expert

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3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT – Detailed photos see attachment A

3.2 Power supply system utilised

Power supply voltage : 100 - 120 VAC

$$V_{nom} = 110 \text{ V}$$
$$V_{\min} = 100 \text{ V}$$
$$V_{\max} = 120 \text{ V}$$

3.3 Short description of the equipment under test (EUT)

The EUT is a WLAN module with host PCB using the 802.11n standard in the 5 GHz bands only. The EUT has a compatibility mode to 802.11a and 802.11h. Three antenna ports supply 2 TX/RX antennas and 1 RX antenna for MIMO operation. The EUT operates as WLAN client without radar interference detection and without TPC.

Number of tested samples: 1 for radiated measurements and 1 for conducted measurements.

Serial number: Reference integration 22008588 and 22008589

EUT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- WLAN transmission

- TX continuous mode

- RX continuous mode

EUT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

The following peripheral devices and interface cables were connected during the measurements:

- Power supply 100 – 120 VAC Model : ENCORE EST-3700, #22017610

- Model :

- Model :

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4 TEST ENVIRONMENT

4.1 Address of the test laboratory

mikes-testingpartners gmbh
Ohmstrasse 2-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader may notice that tolerances within the calibration of the equipment and facilities may cause additional uncertainty. The measurement uncertainty is calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurement“ and documented in the mikes-testingpartners gmbh quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners gmbh, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component diversity and modifications in production process of devices may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for the specific test. The manufacturer has the sole responsibility of continued compliance of the EUT.

4.4 Measurement protocol for FCC

4.4.1 GENERAL INFORMATION

4.4.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

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4.4.1.2 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.2 **DETAILS OF TEST PROCEDURES**General Standard information

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.3 **Conducted emission**Description of measurement

The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit or to the CISPR limit.

To convert between dB μ V and μ V, the following conversions apply:

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \cdot \log(\mu\text{V}); \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)}; \end{aligned}$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50 Ω /50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin of a peak mode measurement appears to be less than 20 dB, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

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4.4.4 Radiated emission (electrical field 30 MHz - 1 GHz)

Description of measurement

Spurious emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarised antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance with ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so that they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. The antenna is positioned 3, 10 or 30 meters horizontally from the EUT and is repeated vertically. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters and the EUT is rotated 360 degrees. The final level in dBµV/m is calculated by taking the reading from the EMI receiver (Level dBµV) and adding the correction factors and cable loss factor (dB). The FCC or CISPR limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

The resolution bandwidth setting:

30 MHz – 1000 MHz: RBW: 120 kHz

Example:

Frequency Delta (MHz)	Level (dBµV)	+	Factor (dB)	=	Level (dBµV/m)	-	CISPR Limit (dBµV/m)	=	(dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

4.4.5 Radiated emission (electrical field 1 GHz - 40 GHz)

Description of measurement

Radiated emissions from the EUT are measured in the frequency range 1 GHz up to the maximum frequency as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is following set out in ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to max peak detector function and a resolution 1 MHz and video bandwidth 3 MHz for peak and 10 Hz for average measurement. The conditions determined as worst case will then be used for the final measurements. When the EUT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty and are calculated at the specified test distance.

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4.5 Determination of worst case measurement conditions

Measurements have been made in all three orthogonal axes and the settings of the EUT were changed to locate at which position and at what setting of the EUT produce the maximum of the emissions. For the further measurement the EUT is set in X position.

The tests are carried out in the following frequency bands:

5.15 - 5.25 GHz, 5.25 - 5.35 GHz and 5.47 - 5.725 GHz

Preliminary tests were performed to find the worse case mode from all possible combinations between available modulations, data rates and small antenna system is determined through pre-scans. The maximum output power depends on used data rate. As worse case the HT20 mode (data rate of 6.5 Mbps with 1 spatial stream (BW = 20 MHz), 1 TX chain) and HT40 mode (data rate of 27 Mbps with 2 spatial streams (BW = 40 MHz)) is used. The EUT is controlled for several tests with special test software used for testing only (RALINK using ATE commands) where continuous signals are needed. For the tests a duty cycle (x) of x = 1 is set.

Following channels and test modes were selected for the final test as listed below:

HT20 mode:

Technology	Available channels	Tested channels	Modulation	Modulation type	Data rate (Mbps)
802.11n	36 - 140	36, 40, 48 52, 56, 64 100, 116, 140	OFDM	BPSK	6.5, MCS=0 (BW=20 MHz)

HT40 mode:

Technology	Available channels	Tested channels	Modulation	Modulation type	Data rate (Mbps)
802.11n	38 - 134	38, 46 54, 62 102, 110, 134	OFDM	BPSK	27, MCS=8 (BW=40 MHz)

802.11a mode:

Technology	Available channels	Tested channels	Modulation	Modulation type	Data rate (Mbps)
802.11a	36 - 140	36, 40, 48 52, 56, 64 100, 116, 140	OFDM	BPSK	6, MCS=0 (BW=20 MHz)

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5 TEST CONDITIONS AND RESULTS

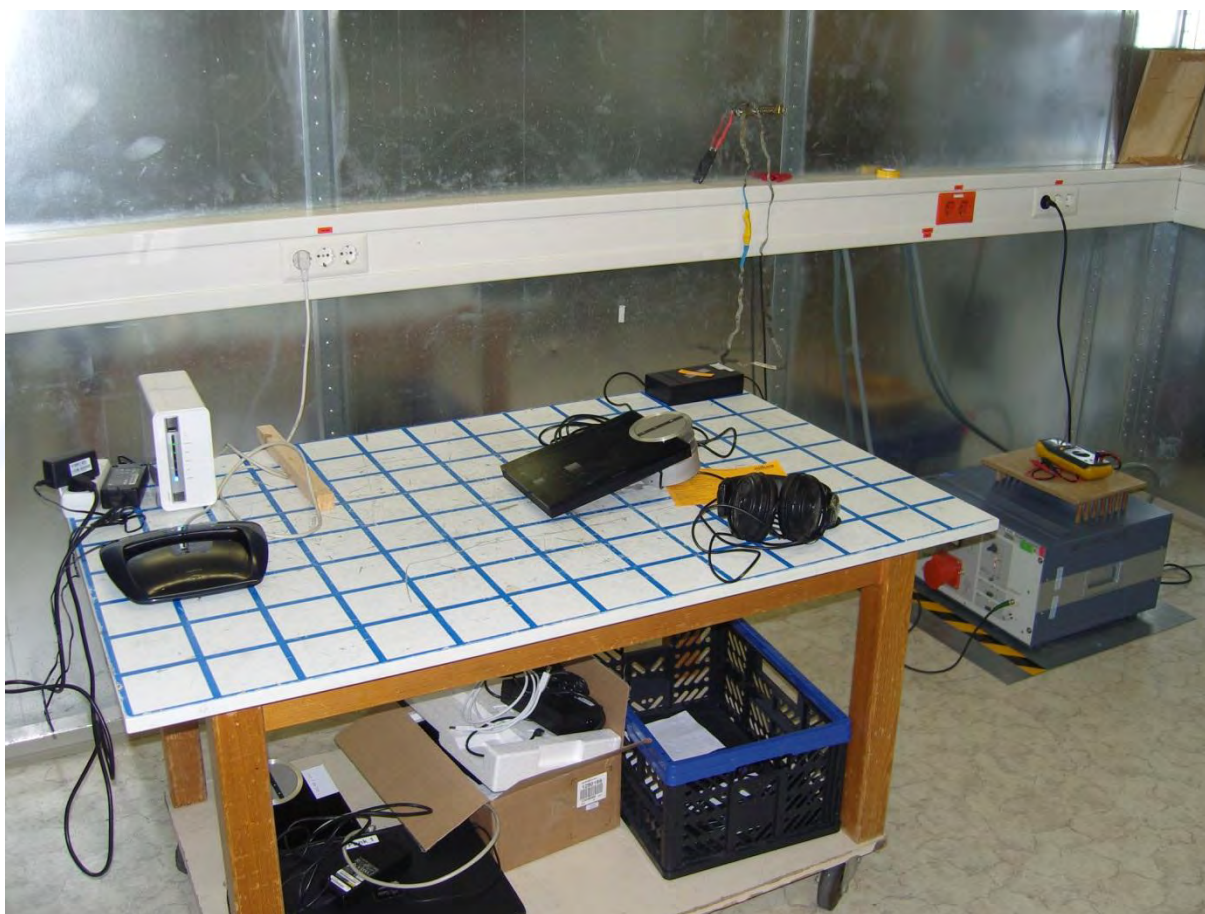
5.1 Conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up



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5.1.3 Applicable standard

According to FCC Part 15C, Section 15.207(a):

Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

5.1.4 Description of Measurement

The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a line impedance stabilization network (LISN) with 50Ω/50 μH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded.

To convert between dBμV and μV, the following conversions apply:

$$\text{dB}\mu\text{V} = 20 \log \mu\text{V}$$

$$\mu\text{V} = 10^{(\text{dB}\mu\text{V}/20)}$$

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin -1.0 dB at 0.64 MHz

The requirements are **FULFILLED**.

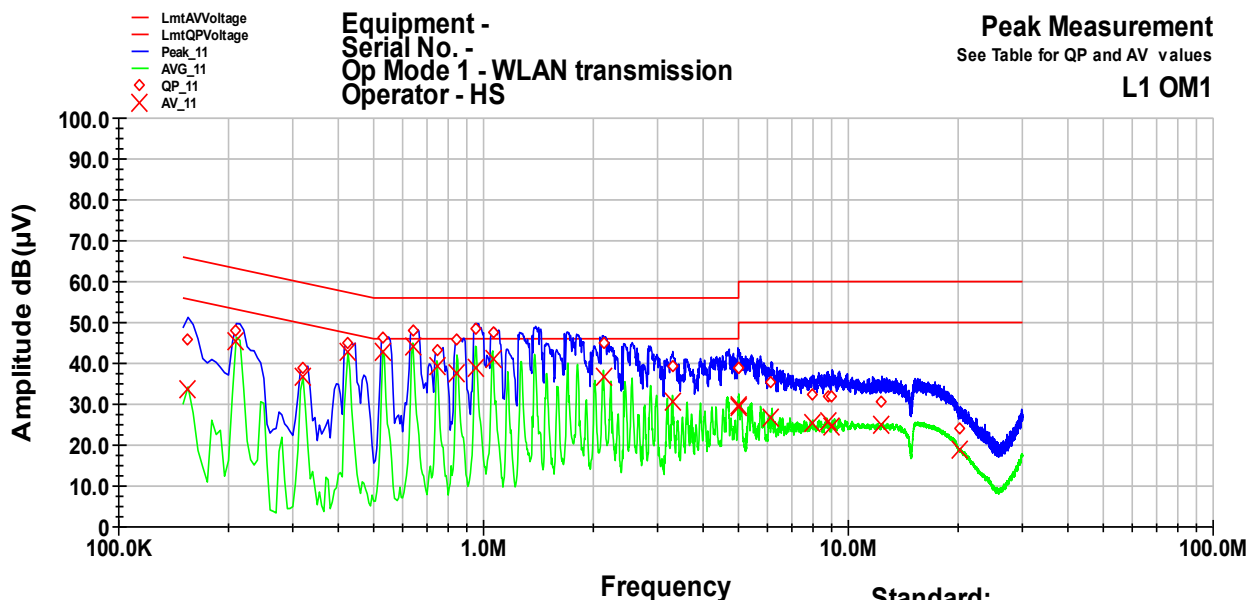
Remarks: For detailed test result please see following test protocols.

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5.1.6 Test protocol

Test point L1
Operation mode: WLAN transmission
Remarks:

Result: Passed



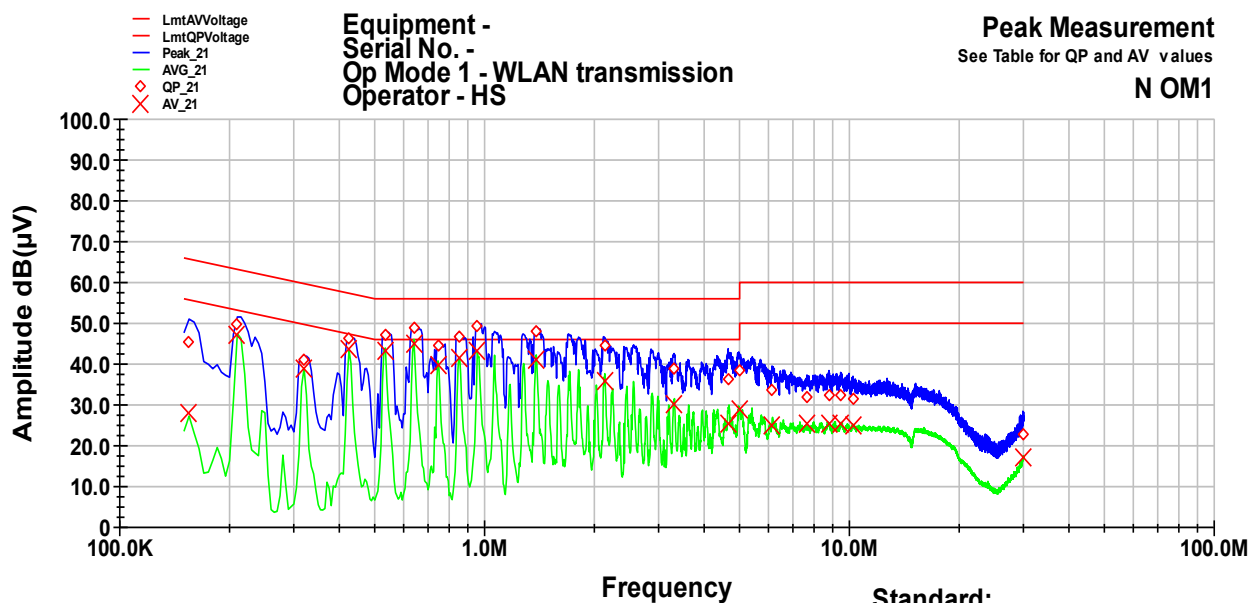
Standard:
File Number: T34325

Frequency MHz	QP Level dB(μV)	QP Margin dB	QP Limit dB	AV Level dB(μV)	AV Margin dB	AV Limit dB
0.155	46.1	-19.6	65.7	33.8	-21.9	55.7
0.21	48.0	-15.2	63.2	45.6	-7.6	53.2
0.32	38.9	-20.8	59.7	36.9	-12.8	49.7
0.425	45.1	-12.2	57.3	42.6	-4.7	47.3
0.53	46.3	-9.7	56.0	42.6	-3.4	46.0
0.64	48.2	-7.8	56.0	44.2	-1.8	46.0
0.745	43.4	-12.6	56.0	39.1	-6.9	46.0
0.845	45.6	-10.4	56.0	37.5	-8.5	46.0
0.95	48.3	-7.7	56.0	39.1	-6.9	46.0
1.06	47.7	-8.3	56.0	40.9	-5.1	46.0
2.13	44.9	-11.1	56.0	36.7	-9.3	46.0
3.3	39.3	-16.7	56.0	30.7	-15.3	46.0
4.98	39.1	-16.9	56.0	29.3	-16.7	46.0
5.005	38.9	-21.1	60.0	29.9	-20.1	50.0
6.145	35.4	-24.6	60.0	26.6	-23.4	50.0
7.975	32.3	-27.7	60.0	25.5	-24.5	50.0
8.785	32.0	-28.0	60.0	25.6	-24.4	50.0
9.02	31.8	-28.2	60.0	24.4	-25.6	50.0
12.35	30.7	-29.3	60.0	24.8	-25.2	50.0
20.265	24.2	-35.8	60.0	18.7	-31.3	50.0

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Test point: N
Operation mode: WLAN transmission
Remarks:

Result: Passed



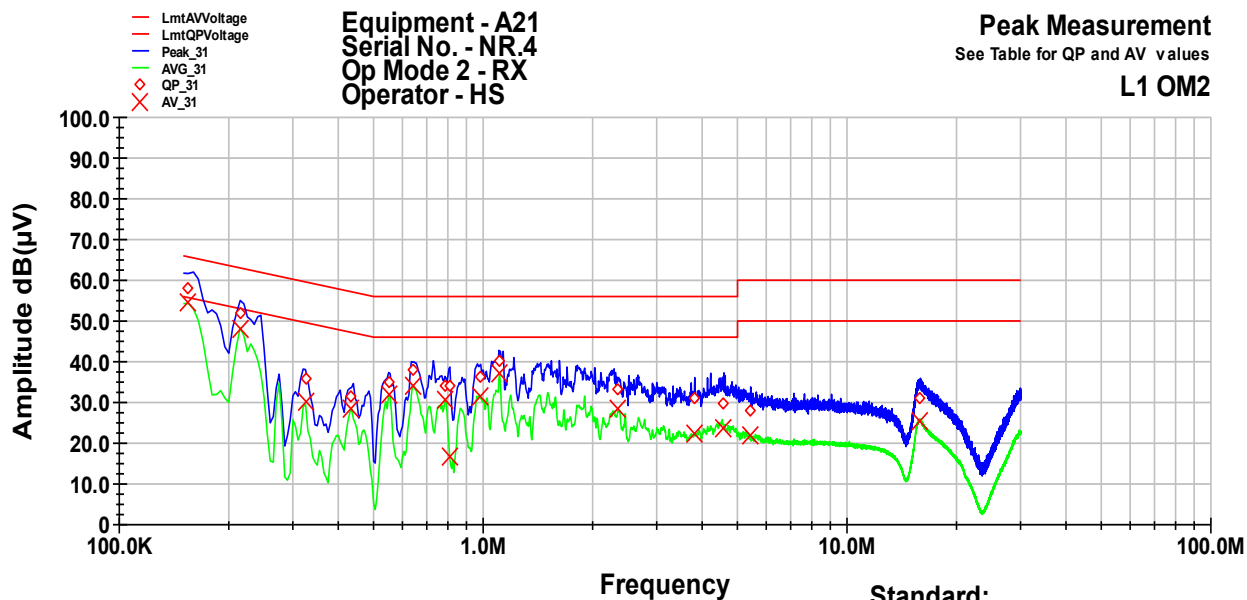
Standard:
File Number: T34325

Frequency MHz	QP Level dB(μV)	QP Margin dB	QP Limit dB	AV Level dB(μV)	AV Margin dB	AV Limit dB
0.155	45.3	-20.4	65.7	28.1	-27.7	55.7
0.21	49.9	-13.3	63.2	47.1	-6.1	53.2
0.32	40.9	-18.8	59.7	39.0	-10.7	49.7
0.425	46.3	-11.0	57.3	43.6	-3.8	47.3
0.535	47.3	-8.7	56.0	43.3	-2.7	46.0
0.64	48.8	-7.2	56.0	45.0	-1.0	46.0
0.745	44.4	-11.6	56.0	39.8	-6.2	46.0
0.85	46.8	-9.2	56.0	41.4	-4.6	46.0
0.955	49.3	-6.7	56.0	43.2	-2.8	46.0
1.385	47.8	-8.2	56.0	40.9	-5.1	46.0
2.135	44.3	-11.7	56.0	35.8	-10.3	46.0
3.305	39.1	-16.9	56.0	30.4	-15.6	46.0
4.65	36.5	-19.5	56.0	25.2	-20.8	46.0
5.025	38.4	-21.6	60.0	28.9	-21.1	50.0
6.135	33.8	-26.2	60.0	25.0	-25.0	50.0
7.645	31.8	-28.2	60.0	25.2	-24.8	50.0
8.785	32.2	-27.8	60.0	25.3	-24.7	50.0
9.46	32.3	-27.7	60.0	25.6	-24.4	50.0
10.22	31.5	-28.5	60.0	24.9	-25.1	50.0
29.865	22.6	-37.4	60.0	17.0	-33.0	50.0

FCC:BV5SMALLENGINE

Test point L1
Operation mode: RX continuous mode
Remarks:

Result: passed

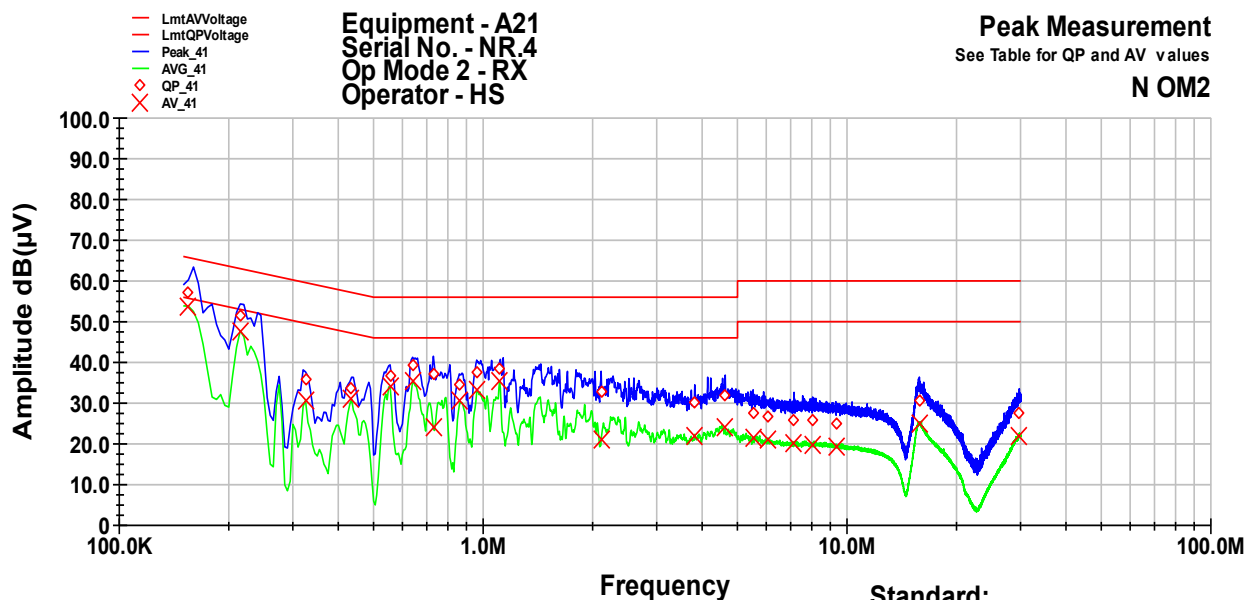


Frequency MHz	QP Level dB(μV)	QP Margin dB	QP Limit dB	AV Level dB(μV)	AV Margin dB	AV Limit dB
0.155	57.8	-7.9	65.7	54.4	-1.3	55.7
0.215	52.1	-10.9	63.0	48.1	-4.9	53.0
0.325	36.0	-23.6	59.6	30.1	-19.5	49.6
0.435	31.4	-25.7	57.2	28.5	-18.7	47.2
0.55	35.1	-20.9	56.0	31.8	-14.2	46.0
0.64	38.0	-18.0	56.0	34.2	-11.8	46.0
0.785	33.9	-22.1	56.0	30.5	-15.5	46.0
0.81	34.3	-21.7	56.0	16.6	-29.4	46.0
0.98	36.2	-19.8	56.0	31.6	-14.4	46.0
1.11	40.0	-16.0	56.0	36.9	-9.1	46.0
2.35	33.1	-22.9	56.0	28.5	-17.5	46.0
3.815	31.1	-24.9	56.0	22.5	-23.5	46.0
4.59	29.5	-26.5	56.0	23.7	-22.3	46.0
5.435	27.9	-32.2	60.0	21.8	-28.2	50.0
15.895	31.0	-29.0	60.0	25.5	-24.5	50.0

FCC:BV5SMALLENGINE

Test point N
Operation mode: RX continuous mode
Remarks:

Result: passed



Standard:
File Number: T34325

Frequency MHz	QP Level dB(μV)	QP Margin dB	QP Limit dB	AV Level dB(μV)	AV Margin dB	AV Limit dB
0.155	57.2	-8.5	65.7	53.9	-1.9	55.7
0.215	51.7	-11.3	63.0	47.7	-5.3	53.0
0.325	36.0	-23.6	59.6	30.8	-18.8	49.6
0.435	33.7	-23.5	57.2	31.0	-16.2	47.2
0.555	36.7	-19.3	56.0	34.0	-12.0	46.0
0.64	39.3	-16.8	56.0	35.6	-10.4	46.0
0.73	37.2	-18.8	56.0	24.0	-22.0	46.0
0.865	34.5	-21.5	56.0	30.5	-15.5	46.0
0.965	37.8	-18.3	56.0	33.1	-12.9	46.0
1.11	38.5	-17.5	56.0	35.5	-10.5	46.0
2.11	32.6	-23.4	56.0	20.9	-25.1	46.0
3.815	30.3	-25.7	56.0	22.0	-24.0	46.0
4.625	31.9	-24.1	56.0	24.1	-21.9	46.0
5.52	27.7	-32.3	60.0	21.3	-28.7	50.0
6.06	26.9	-33.2	60.0	21.2	-28.8	50.0
7.15	25.8	-34.2	60.0	20.0	-30.0	50.0
8.045	25.6	-34.3	60.0	19.9	-30.1	50.0
9.315	25.0	-35.0	60.0	19.3	-30.8	50.0
15.795	30.5	-29.5	60.0	25.0	-25.0	50.0
29.735	27.7	-32.3	60.0	22.1	-27.9	50.0

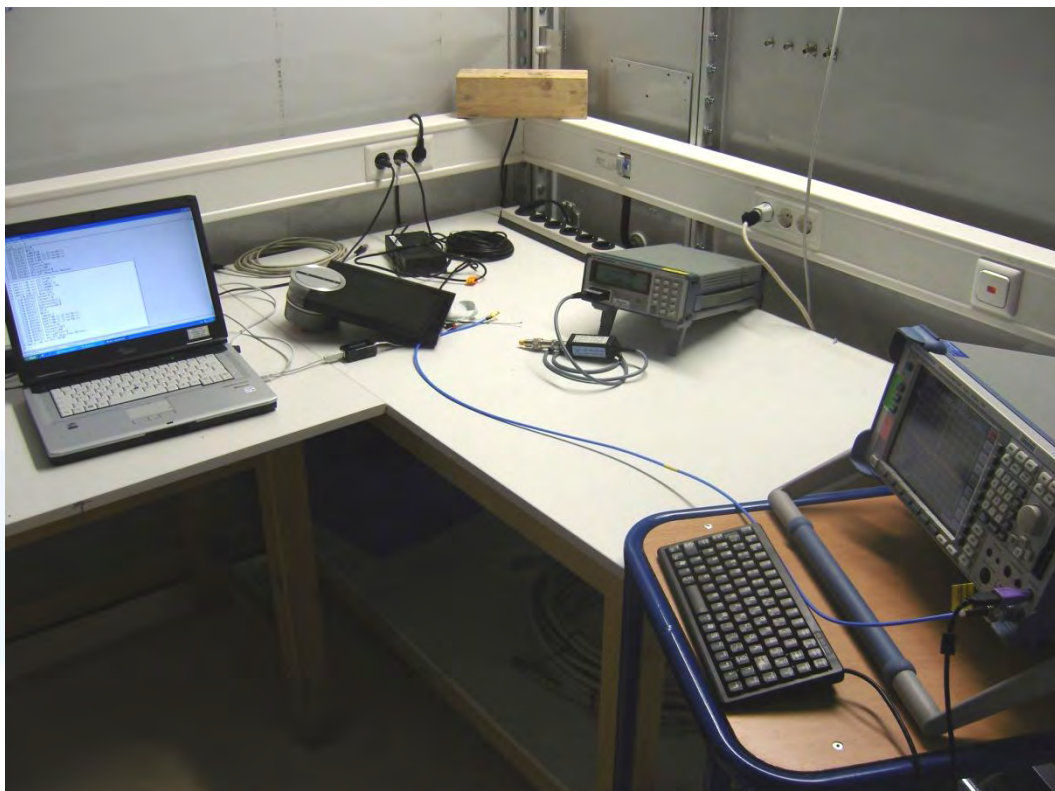
FCC:BV5SMALLENGINE

5.2 26 dB emission bandwidth

For test instruments and accessories used see section 6 Part MB.

5.2.1 Description of the test location

Test location: AREA4

5.2.2 Photo documentation of the test set-up**5.2.3 Applicable standard**

According to FCC Part 15E, Section 15.407(i):

The emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum of the modulated carrier.

5.2.4 Description of Measurement

The bandwidth was measured at an amplitude level reduced from the reference level by a specified ratio of -26 dB. The reference level is the level of the highest amplitude of the signal observed from the transmitter frequency. The spectrum analyser function "n-dB-down" is used to determine the bandwidth.

FCC:BV5SMALLENGINE

5.2.5 Test result

HT20 mode, Ant1:

Spectrum analyzer settings: RBW: 100 kHz VBW: 300 kHz Detector: Peak

Channel number	Center frequency (MHz)	26 dB bandwidth (MHz)
36	5180	19.76
40	5200	19.76
48	5240	19.76
52	5260	19.92
56	5280	19.28
64	5320	19.12
100	5500	19.04
116	5580	19.28
140	5700	19.42

HT20 mode, Ant2:

Channel number	Center frequency (MHz)	26 dB bandwidth (MHz)
36	5180	19.36
40	5200	19.12
48	5240	19.12
52	5260	19.04
56	5280	19.12
64	5320	19.20
100	5500	18.96
116	5580	19.36
140	5700	19.04

HT40 mode, Ant1:

Spectrum analyzer settings: RBW: 300 kHz VBW: 1 MHz Detector: Peak

Channel number	Center frequency (MHz)	26 dB bandwidth (MHz)
38	5190	39.36
46	5230	39.52
54	5270	39.68
62	5310	38.56
102	5510	42.40
110	5550	39.20
134	5670	39.20

HT40 mode, Ant2:

Channel number	Center frequency (MHz)	26 dB bandwidth (MHz)
38	5190	38.88
46	5230	41.76
54	5270	38.88
62	5310	38.24
102	5510	38.56
110	5550	39.36
134	5670	38.56

FCC:BV5SMALLENGINE

802.11a mode, Ant1:

Spectrum analyzer settings: RBW: 100 kHz VBW: 300 kHz Detector: Peak

Channel number	Center frequency (MHz)	26 dB bandwidth (MHz)
36	5180	18.24
40	5200	18.48
48	5240	18.56
52	5260	18.40
56	5280	18.40
64	5320	18.16
100	5500	18.32
116	5580	18.24
140	5700	18.80

802.11a mode, Ant2:

Spectrum analyzer settings: RBW: 100 kHz VBW: 300 kHz Detector: Peak

Channel number	Center frequency (MHz)	26 dB bandwidth (MHz)
36	5180	18.16
40	5200	18.56
48	5240	18.16
52	5260	18.24
56	5280	18.72
64	5320	18.48
100	5500	18.48
116	5580	18.80
140	5700	18.32

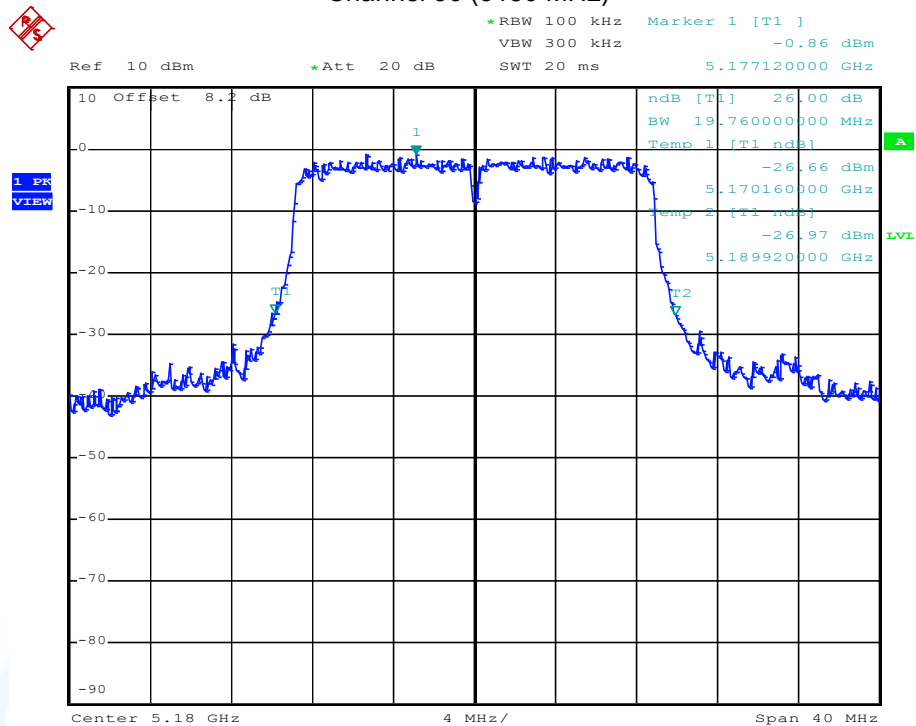
Remarks: For detailed test results please see the following test protocols. Only the worst case of the plots are listed.

FCC:BV5SMALLENGINE

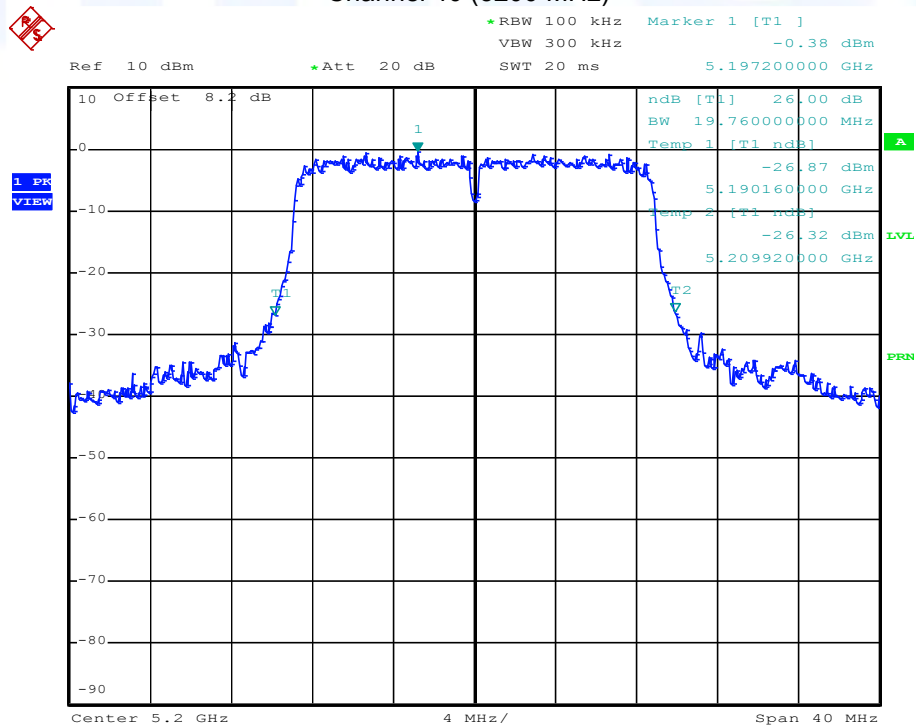
5.2.6 Test protocol

26dB Bandwidth Measurement plots, HT20, Ant1

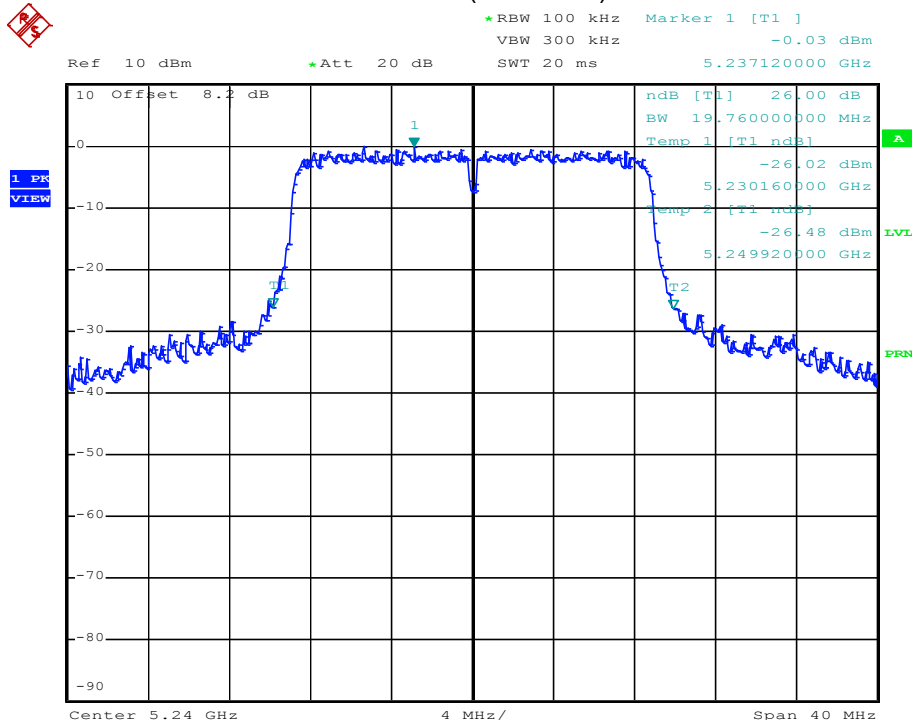
Channel 36 (5180 MHz)



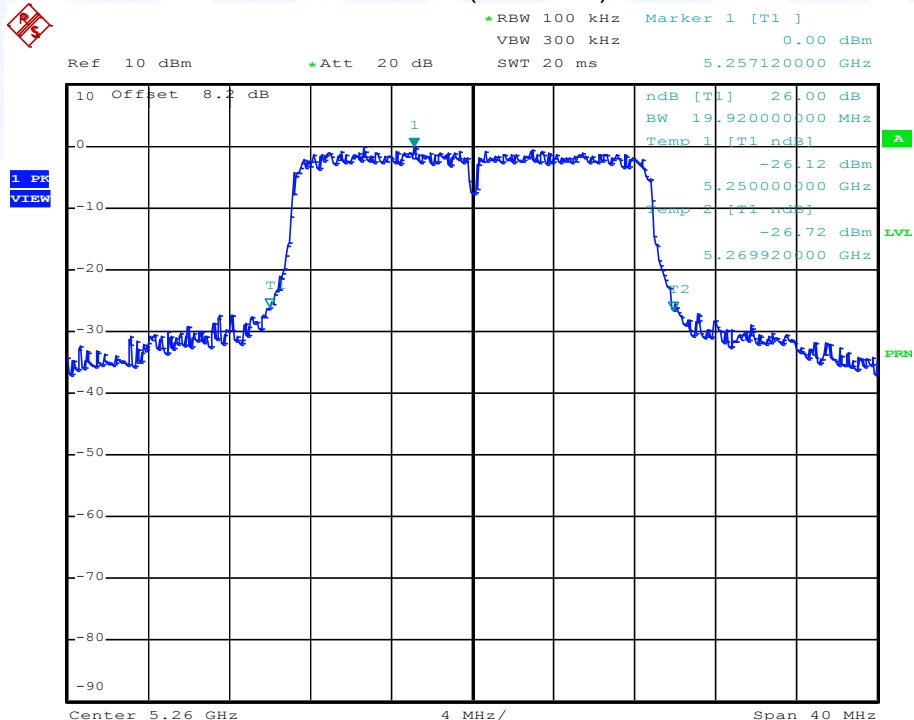
Channel 40 (5200 MHz)



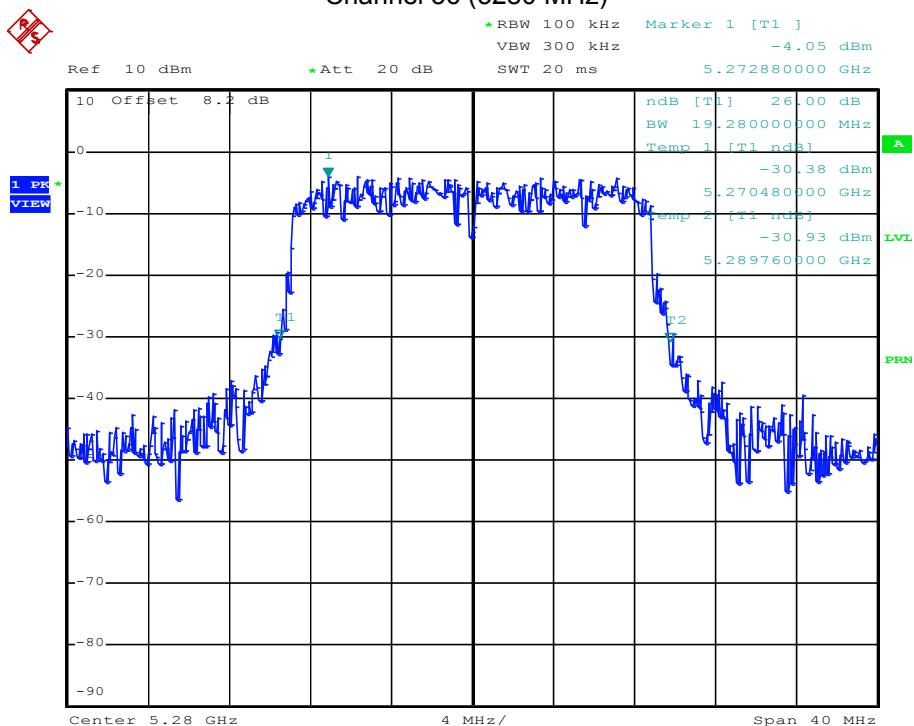
FCC:BV5SMALENGINE Channel 48 (5240 MHz)



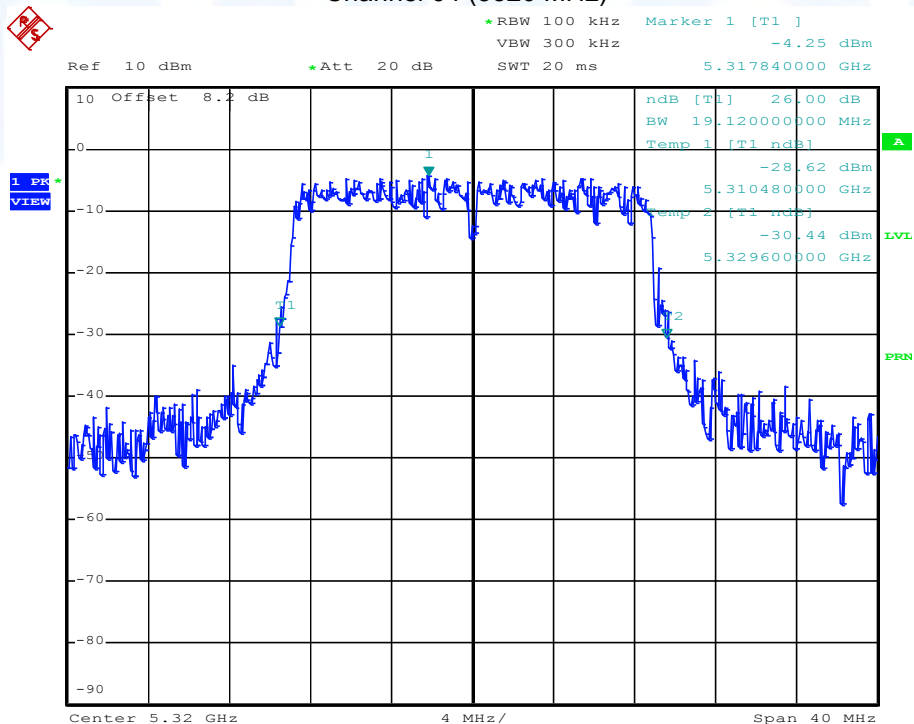
Channel 52 (5260 MHz)



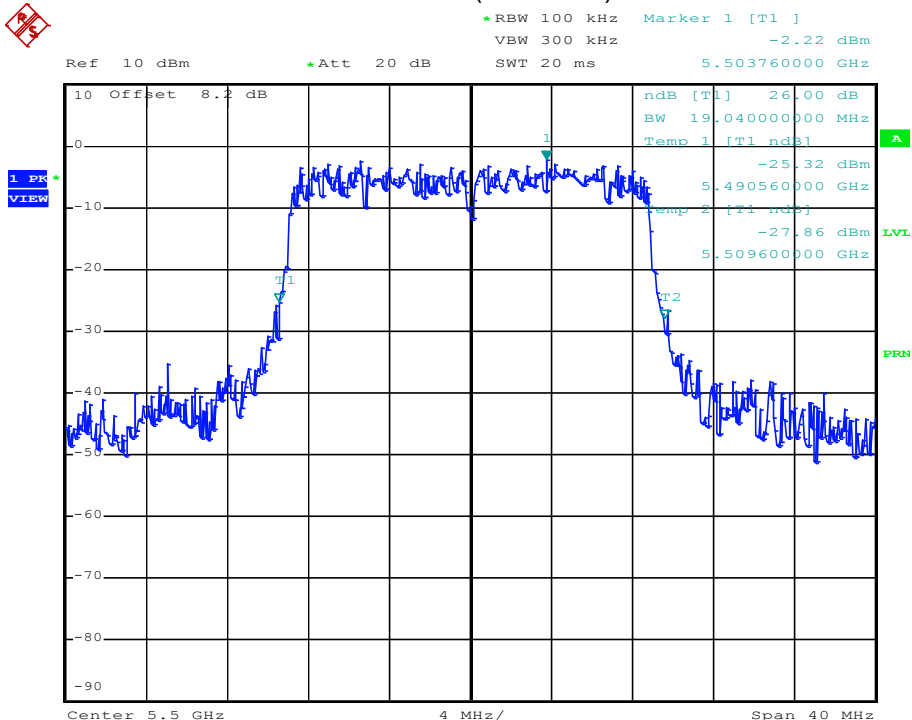
FCC:BV5SMALLENGINE Channel 56 (5280 MHz)



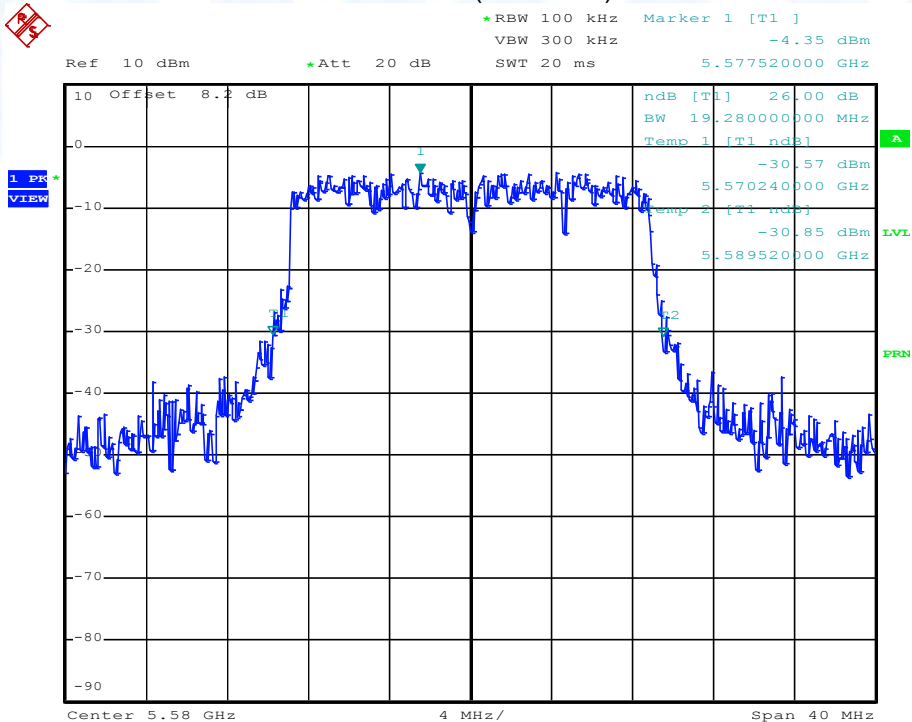
Channel 64 (5320 MHz)



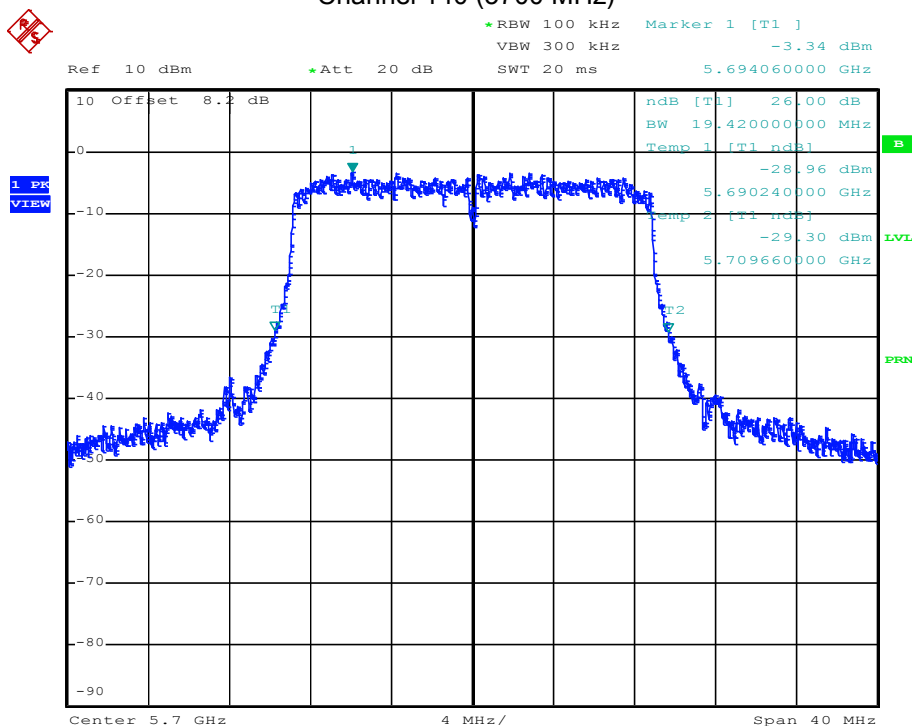
FCC:BV5SMALLENGINE Channel 100 (5500 MHz)



Channel 116 (5580 MHz)

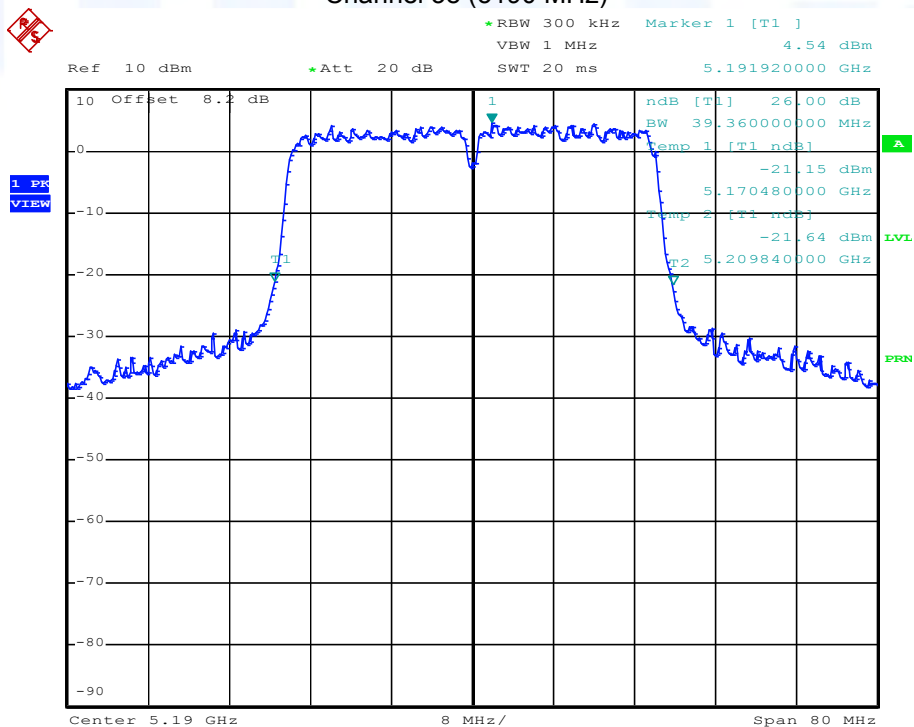


FCC:BV5SMALLENGINE Channel 140 (5700 MHz)

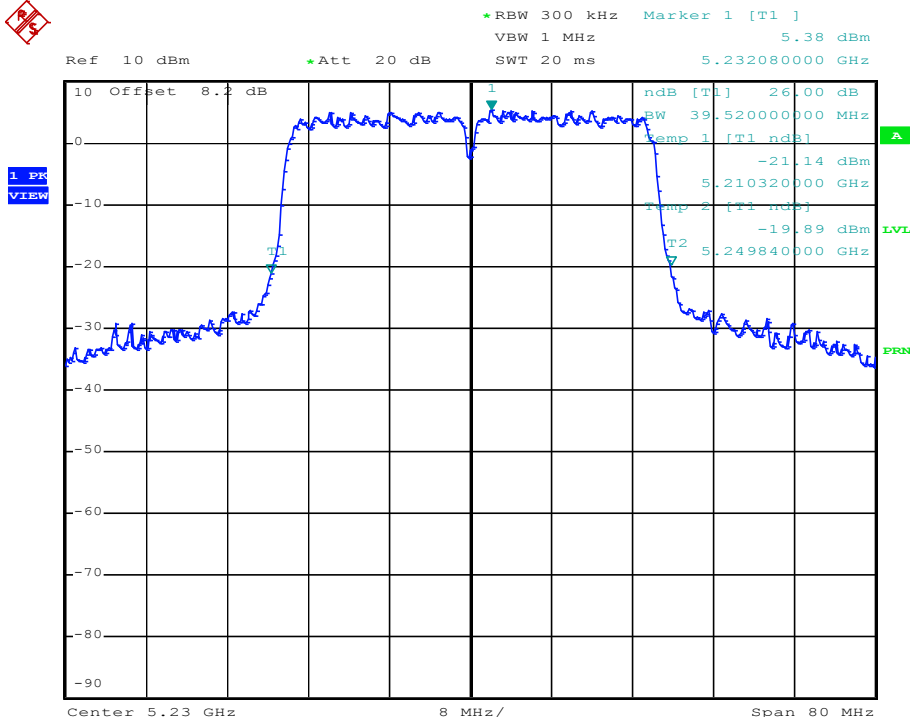


26dB Bandwidth Measurement plots, HT40, Ant1

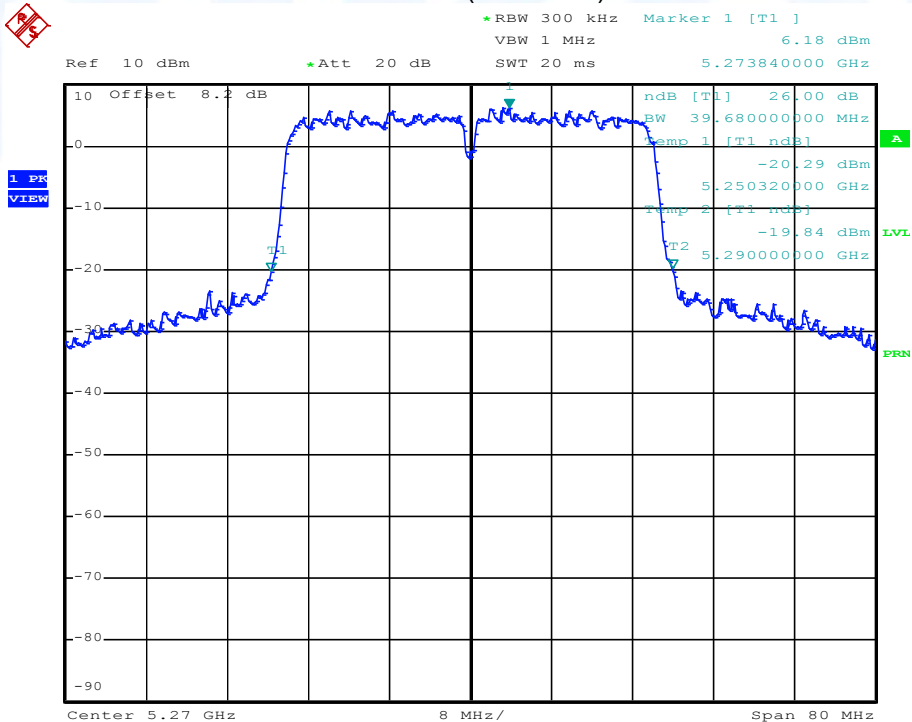
Channel 38 (5190 MHz)



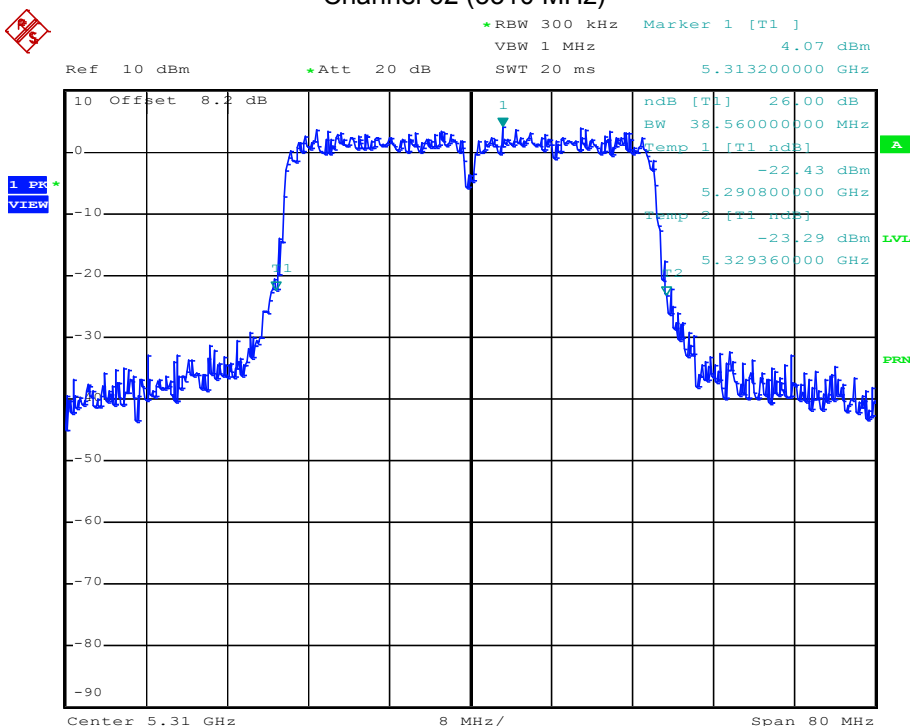
FCC:BV5SMALLENGINE Channel 44 (5230 MHz)



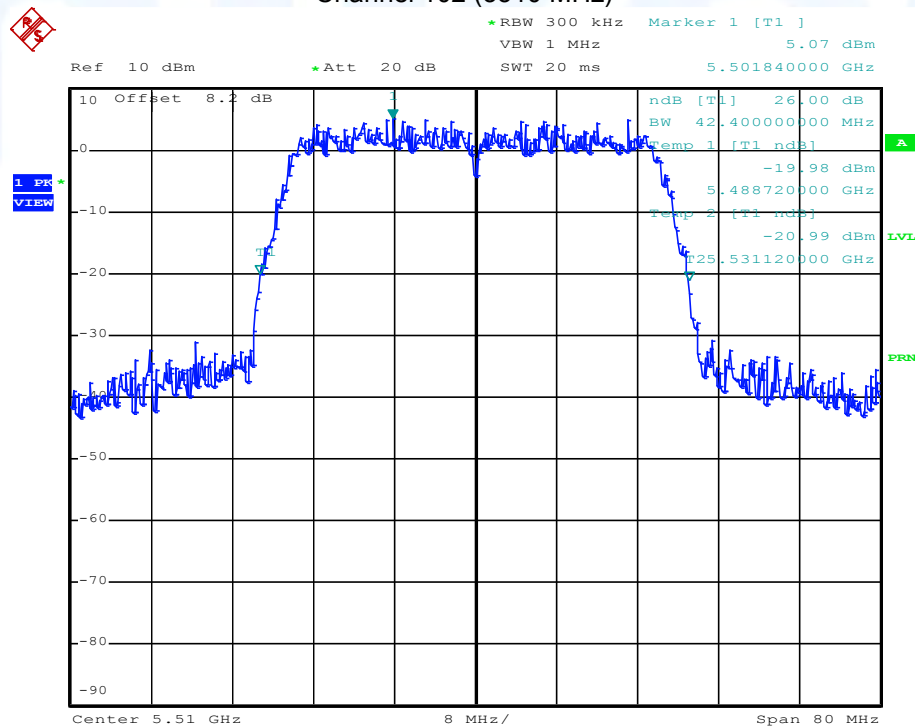
Channel 54 (5270 MHz)



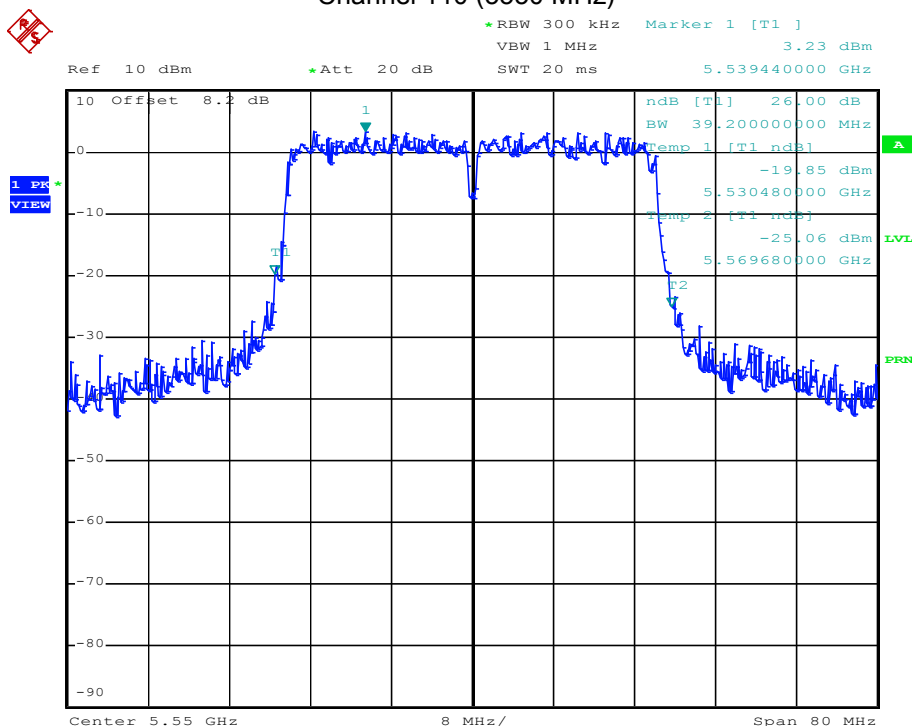
FCC:BV5SMALLENGINE Channel 62 (5310 MHz)



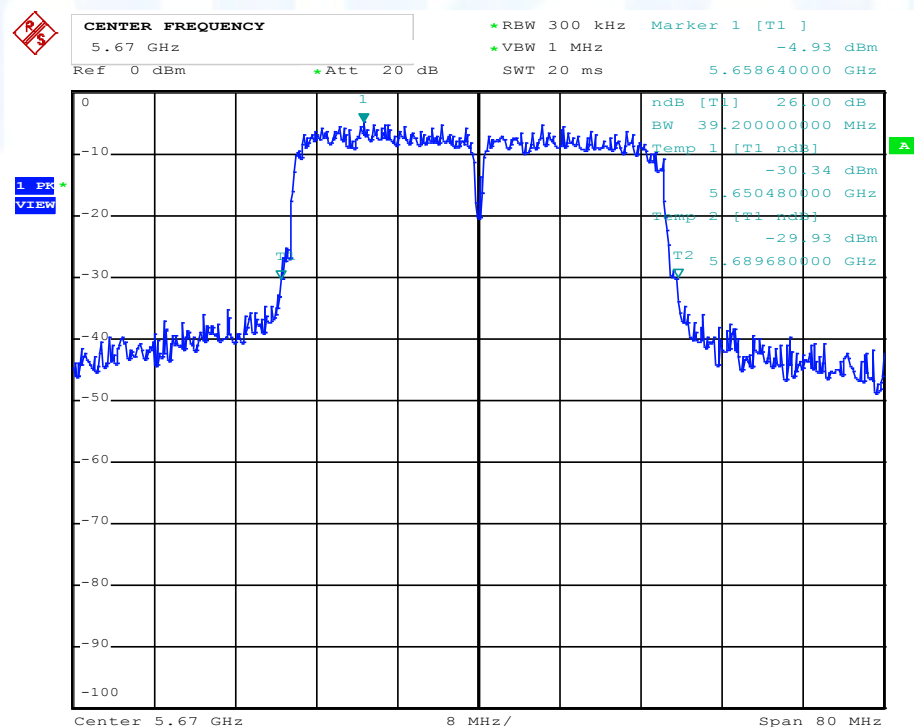
Channel 102 (5510 MHz)



FCC:BV5SMALLENGINE Channel 110 (5550 MHz)



Channel 134 (5670 MHz)



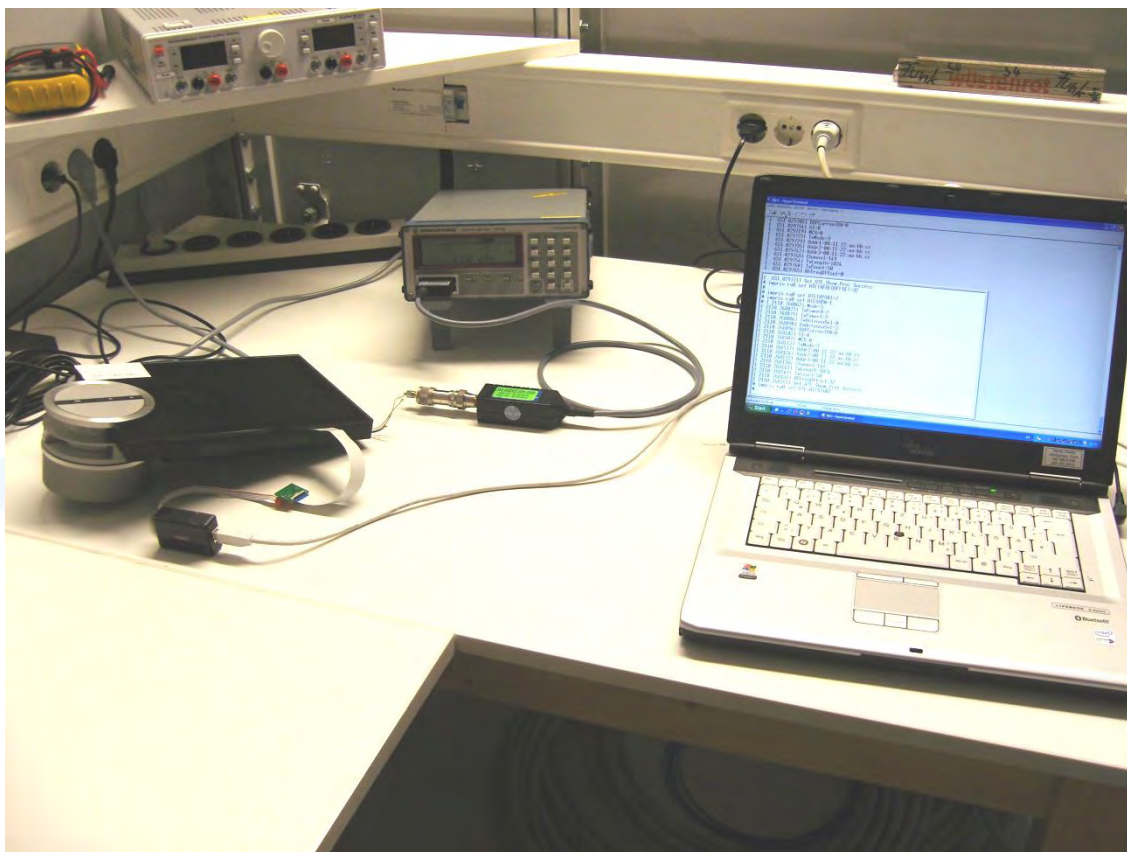
FCC:BV5SMALLENGINE

5.3 Maximum conducted output power

For test instruments and accessories used see section 6 Part CPC 3.

5.3.1 Description of the test location

Test location: AREA4

5.3.2 Photo documentation of the test set-up**5.3.3 Applicable standard**

According to FCC Part 15E, Section 15.407(a):

The maximum conducted output power over the frequency band of operation shall not exceed the effective values. If transmitting antennas of directional gain are greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.3.4 Description of Measurement

The output power is measured using the power meter method according ANSI C63.10, clause 6.10.2.2. The EUT is set while measuring in TX continuous mode with a duty cycle, $x = 1$. The total output power is summed over all antenna terminals of the multiple antenna system.

FCC:BV5SMALLENGINE

5.3.5 Test result

HT20 mode, Ant1:

CH	Frequency (MHz)	Power setting	Measured power (dBm)	Conducted power limit (dBm)	Delta (dB)
36	5180	3	13.3	17.0	-3.7
40	5200	2	12.6	17.0	-1.0
48	5240	2	13.5	17.0	-0.4
52	5260	1	13.0	23.8	-7.5
56	5280	1	13.3	23.8	-7.1
64	5320	1	14.0	23.8	-7.3
100	5500	0	13.3	23.8	-6.5
116	5580	0	12.5	23.8	-6.9
140	5700	2	12.7	23.8	-8.1

HT20 mode, Ant2:

CH	Frequency (MHz)	Power setting	Measured power (dBm)	Conducted power limit (dBm)	Delta (dB)
36	5180	5	13.6	17.0	-3.4
40	5200	4	13.3	17.0	-3.7
48	5240	3	13.7	17.0	-3.3
52	5260	2	13.5	23.8	-10.3
56	5280	2	14.0	23.8	-9.8
64	5320	0	12.9	23.8	-10.9
100	5500	0	15.1	23.8	-8.7
116	5580	-1	15.0	23.8	-8.8
140	5700	2	12.7	23.8	-11.1

HT20 mode, Ant1 + ANT2:

CH	Frequency (MHz)	Power setting	Summed power Ant1 + ANT2 (dBm)	Conducted power limit (dBm)	Delta (dB)
36	5180		16.5	17.0	-0.5
40	5200		16.0	17.0	-1.0
48	5240		16.6	17.0	-0.4
52	5260		16.3	23.8	-7.5
56	5280		16.7	23.8	-7.1
64	5320		16.5	23.8	-7.3
100	5500		17.3	23.8	-6.5
116	5580		16.9	23.8	-6.9
140	5700		15.7	23.8	-8.1

Note: The summed power is calculated from the measured power of Ant1 and Ant2;

HT40 mode, ANT1:

CH	Frequency (MHz)	Power setting	Measured power (dBm)	Conducted power limit (dBm)	Delta (dB)
38	5190	3	13.5	17.0	-3.5
46	5230	2	13.2	17.0	-3.8
54	5270	1	13.1	24.0	-10.9
62	5310	0	12.8	24.0	-11.2
102	5510	0	13.0	24.0	-11.0
110	5550	0	12.6	24.0	-11.4
134	5670	2	13.0	24.0	-11.0

FCC:BV5SMALLENGINE

HT40 mode, ANT2:

CH	Frequency (MHz)	Power setting	Measured power (dBm)	Conducted power limit (dBm)	Delta (dB)
38	5190	5	12.6	17.0	-4.4
46	5230	3	12.1	17.0	-4.9
54	5270	2	12.5	24.0	-11.5
62	5310	2	13.2	24.0	-10.8
102	5510	-2	12.5	24.0	-11.5
110	5550	-2	12.7	24.0	-11.3
134	5670	2	12.9	24.0	-11.1

HT40 mode, ANT1 + ANT2:

CH	Frequency (MHz)	Power setting	Summed power Ant1 + ANT2 (dBm)	Conducted power limit (dBm)	Delta (dB)
38	5190		16.1	17.0	-0.9
46	5230		15.7	17.0	-1.3
54	5270		15.8	24.0	-8.2
62	5310		16.0	24.0	-8.0
102	5510		15.8	24.0	-8.2
110	5550		15.7	24.0	-8.3
134	5670		16.0	24.0	-8.0

Note: The summed power is calculated from the measured power of Ant1 and Ant2;

802.11a mode, Ant1:

CH	Frequency (MHz)	Power setting	Measured power (dBm)	Conducted power limit (dBm)	Delta (dB)
36	5180	3	13.3	17.0	-3.7
40	5200	2	13.1	17.0	-3.9
48	5240	2	13.7	17.0	-3.3
52	5260	1	12.7	23.8	-11.1
56	5280	1	12.9	23.8	-10.9
64	5320	1	13.7	23.8	-10.1
100	5500	0	13.3	23.8	-10.5
116	5580	0	12.5	23.8	-11.3
140	5700	2	12.3	23.8	-11.5

802.11a mode, Ant2:

CH	Frequency (MHz)	Power setting	Measured power (dBm)	Conducted power limit (dBm)	Delta (dB)
36	5180	5	13.3	17.0	-3.7
40	5200	4	13.1	17.0	-3.9
48	5240	3	13.3	17.0	-3.7
52	5260	2	12.8	23.8	-11.0
56	5280	2	13.3	23.8	-10.5
64	5320	0	12.1	23.8	-11.7
100	5500	0	14.5	23.8	-9.3
116	5580	-1	14.3	23.8	-9.5
140	5700	2	11.9	23.8	-11.9

FCC:BV5SMALLENGINE

CH	Frequency (MHz)	Power setting	Summed power Ant1 + ANT2 (dBm)	Conducted power limit (dBm)	Delta (dB)
36	5180		16.3	17.0	-0.7
40	5200		16.1	17.0	-0.9
48	5240		16.5	17.0	-0.5
52	5260		15.8	23.8	-8.0
56	5280		16.1	23.8	-7.7
64	5320		16.0	23.8	-7.8
100	5500		17.0	23.8	-6.8
116	5580		16.5	23.8	-7.3
140	5700		15.1	23.8	-8.7

Note: The summed power is calculated from the measured power of Ant1 and Ant2;

Peak power limit according to FCC Part 15E, Section 15.407(a):

Frequency (GHz)	Conducted power limit	
	(dBm)	(mW)
5.150 - 5.250	17	50
	HT20, $4 + 10 \log B = 17$	50
	HT40, $4 + 10 \log B = 19.9$	98
5.250 - 5.350	24	250
	HT20, $11 + 10 \log B = 23.8$	240
	HT40, $11 + 10 \log B = 26.9$	490
5.470 - 5.725	24	250
	HT20, $11 + 10 \log B = 23.8$	240
	HT40, $11 + 10 \log B = 26.9$	490

Note: The lower limit applies!

The requirements are **FULFILLED**.

Remarks: This test has been performed conducted at the 20 cm antenna cable of WLAN module.

FCC:BV5SMALLENGINE

5.4 Peak power spectral density

For test instruments and accessories used see section 6 Part CPC 3.

5.4.1 Description of the test location

Test location: AREA 4

5.4.2 Photo documentation of the test set-up**5.4.3 Applicable standard**

According to FCC Part 15E, Section 15.407(a):

For the defined operating bands the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than the appropriate limit in any 1 MHz band during any time interval of continuous transmission.

5.4.4 Description of Measurement

The measurement is performed using the procedure set out in DA 02-2138, PSD Method 2. For this MIMO transmitter the antenna output 1 is measured and the output 2 is taken into account with the formula according OET 662911, $10 \log(N)$, where N is the number of outputs. The total sum is calculated to add a correction factor of 3 dB ($10 \log 2$) to the analyser reading of each antenna output.

Settings on the spectrum analyzer:

RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto, Detector: SA, Sweep count: 100

FCC:BV5SMALLENGINE

5.4.5 Test result

HT20, Ant1, MCS0:

Channel	Center frequency (MHz)	Power setting	Reading Ant1 (dBm/Hz)	Correction output2 (dB)	Total PPSP (dBm)	Limit (dBm)
36	5180	3	0.1	3.0	3.1	4.0
40	5200	2	0.1	3.0	3.1	4.0
48	5240	2	0.7	3.0	3.7	4.0
52	5260	1	0.6	3.0	3.6	11.0
56	5280	1	0.8	3.0	3.8	11.0
64	5320	1	0.8	3.0	3.8	11.0
100	5500	0	0.2	3.0	3.2	11.0
116	5580	0	-0.9	3.0	2.1	11.0
140	5700	2	0.7	3.0	3.7	11.0

HT20, Ant2:

Channel	Center frequency (MHz)	Power setting	Reading Ant2 (dBm/Hz)	Correction output2 (dB)	Total PPSP (dBm)	Limit (dBm)
36	5180	5	0.0	3.0	3.0	4.0
40	5200	4	-0.2	3.0	2.8	4.0
48	5240	3	0.2	3.0	3.2	4.0
52	5260	2	-0.4	3.0	2.6	11.0
56	5280	2	0.3	3.0	3.3	11.0
64	5320	0	-1.2	3.0	1.8	11.0
100	5500	0	0.9	3.0	3.9	11.0
116	5580	-1	0.7	3.0	3.7	11.0
140	5700	2	-0.9	3.0	2.1	11.0

HT40, Ant1, MCS8:

Channel	Center frequency (MHz)	Power setting	Reading Ant1 (dBm/Hz)	Correction output2 (dB)	Total PPSP (dBm)	Limit (dBm)
38	5190	3	-2.3	3.0	0.7	4.0
46	5230	2	-2.0	3.0	1.0	4.0
54	5270	1	-2.6	3.0	0.4	11.0
62	5310	0	-3.0	3.0	0.0	11.0
102	5510	0	-3.5	3.0	-0.5	11.0
110	5550	0	-3.6	3.0	-0.6	11.0
134	5670	2	-3.4	3.0	-0.4	11.0

HT40, Ant2:

Channel	Center frequency (MHz)	Power setting	Reading Ant2 (dBm/Hz)	Correction output2 (dB)	Total PPSP (dBm)	Limit (dBm)
38	5190	5	-3.0	3.0	0.0	4.0
46	5230	3	-2.3	3.0	0.7	4.0
54	5270	2	-2.9	3.0	0.1	11.0
62	5310	2	-2.7	3.0	0.3	11.0
102	5510	-2	-3.4	3.0	-0.4	11.0
110	5550	-2	-3.7	3.0	-0.7	11.0
134	5670	1	-3.4	3.0	-0.4	11.0

FCC:BV5SMALLENGINE

802.11a, Ant1, MCS0:

Channel	Center frequency (MHz)	Power setting	Reading Ant1 (dBm/Hz)	Correction output2 (dB)	Total PPSD (dBm)	Limit (dBm)
36	5180	3	0.96	3.0	3.96	4.0
40	5200	2	0.4	3.0	3.4	4.0
48	5240	2	0.9	3.0	3.9	4.0
52	5260	1	0.8	3.0	3.8	11.0
56	5280	1	0.8	3.0	3.8	11.0
64	5320	1	1.0	3.0	4.0	11.0
100	5500	0	0.5	3.0	3.5	11.0
116	5580	0	-0.6	3.0	2.4	11.0
140	5700	2	0.4	3.0	3.4	11.0

802.11a, Ant2:

Channel	Center frequency (MHz)	Power setting	Reading Ant2 (dBm/Hz)	Correction output2 (dB)	Total PPSD (dBm)	Limit (dBm)
36	5180	5	-0.2	3.0	2.8	4.0
40	5200	4	-0.1	3.0	2.9	4.0
48	5240	3	0.5	3.0	3.5	4.0
52	5260	2	0.1	3.0	3.1	11.0
56	5280	2	0.5	3.0	3.5	11.0
64	5320	0	-0.7	3.0	2.3	11.0
100	5500	0	0.8	3.0	3.8	11.0
116	5580	-1	0.9	3.0	3.9	11.0
140	5700	2	-0.2	3.0	2.8	11.0

Peak power limit according to FCC Part 15E, Section 15.407(a):

Frequency (GHz)	Peak power spectral density limit (dBm/MHz)
5.150 - 5.250	4
5.250 - 5.350	11
5.470 - 5.725	11

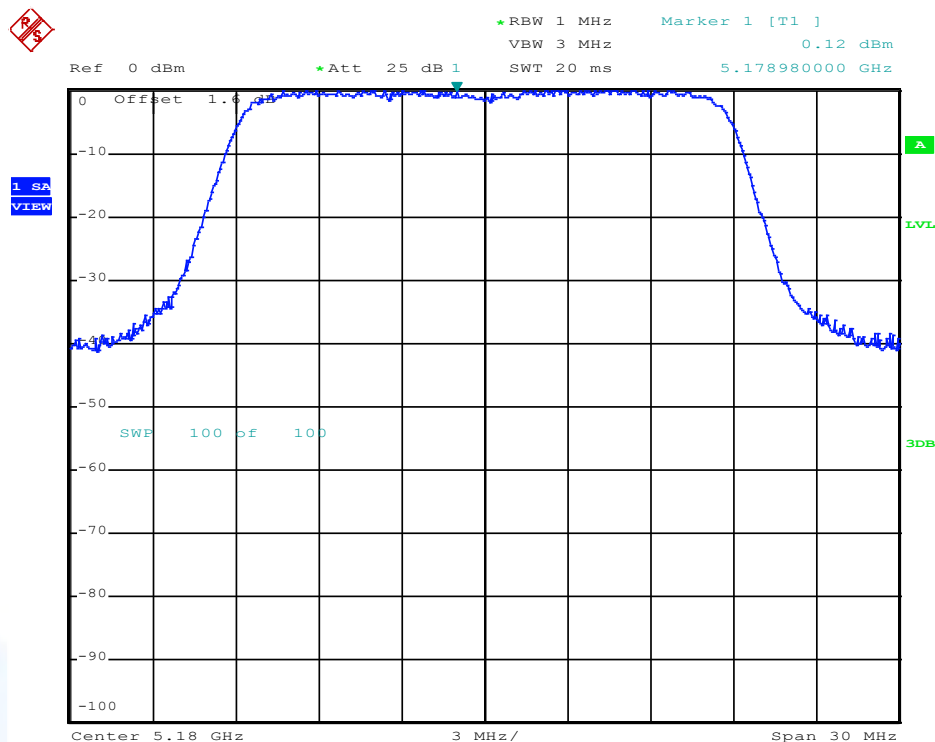
The requirements are **FULFILLED**.

Remarks: For detailed test results please refer to following test protocols. Only the worst case of the plots are listed

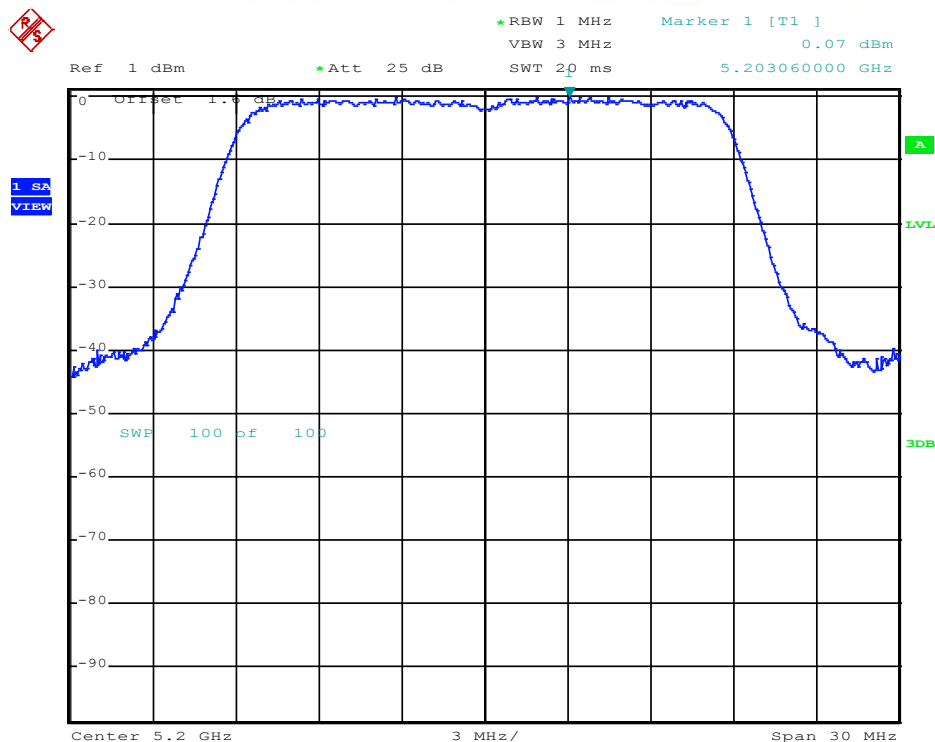
FCC:BV5SMALLENGINE

5.4.6 Peak Power spectral density plots

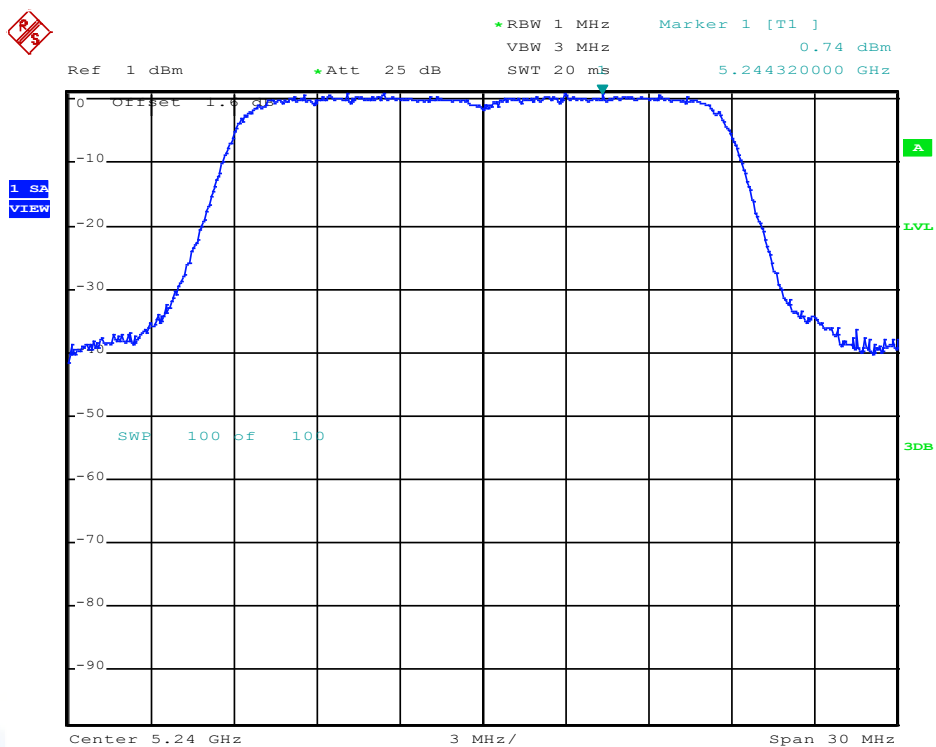
HT20, Ant1:
Channel 36 (5180 MHz)



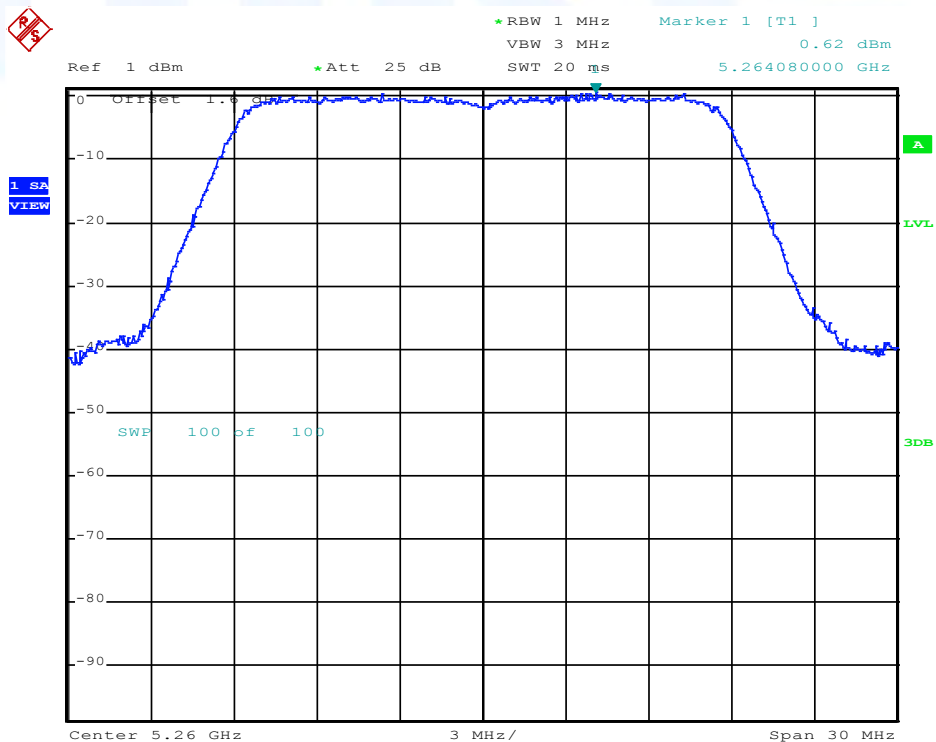
Channel 40 (5200 MHz)



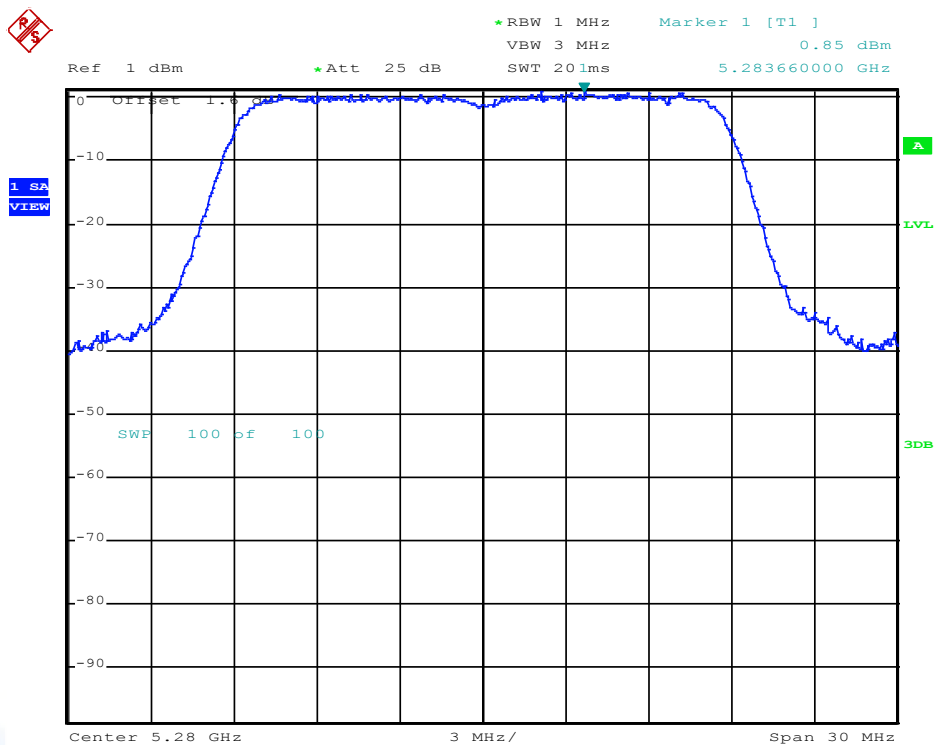
FCC:BV5SMALLENGINE Channel 48 (5240 MHz)



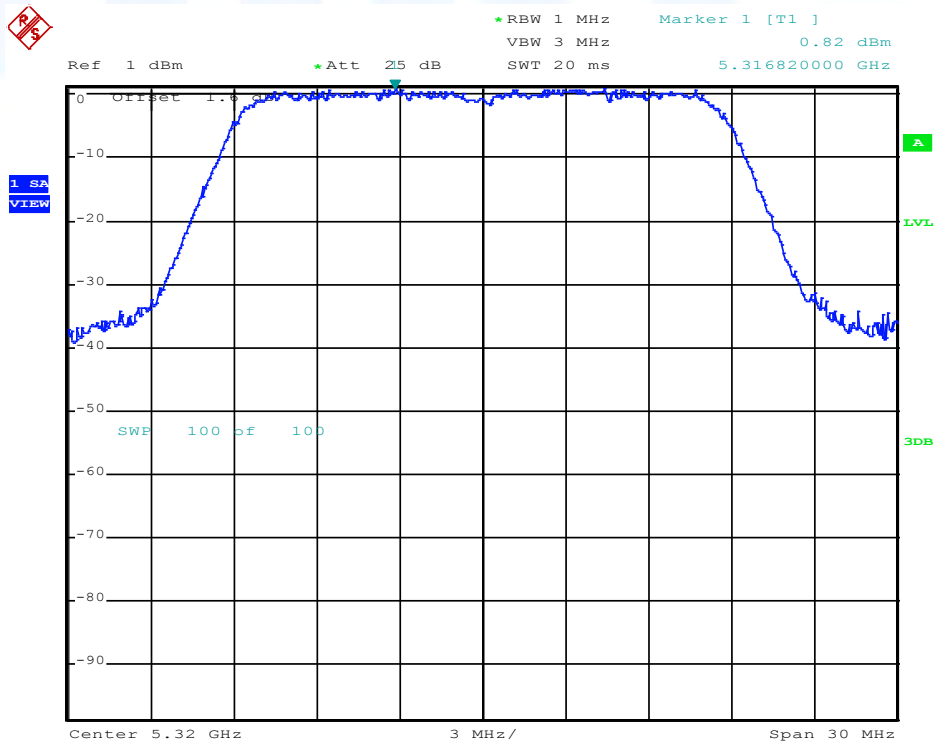
Channel 52 (5260 MHz)



FCC:BV5SMALLENGINE Channel 56 (5280 MHz)



Channel 64 (5320 MHz)

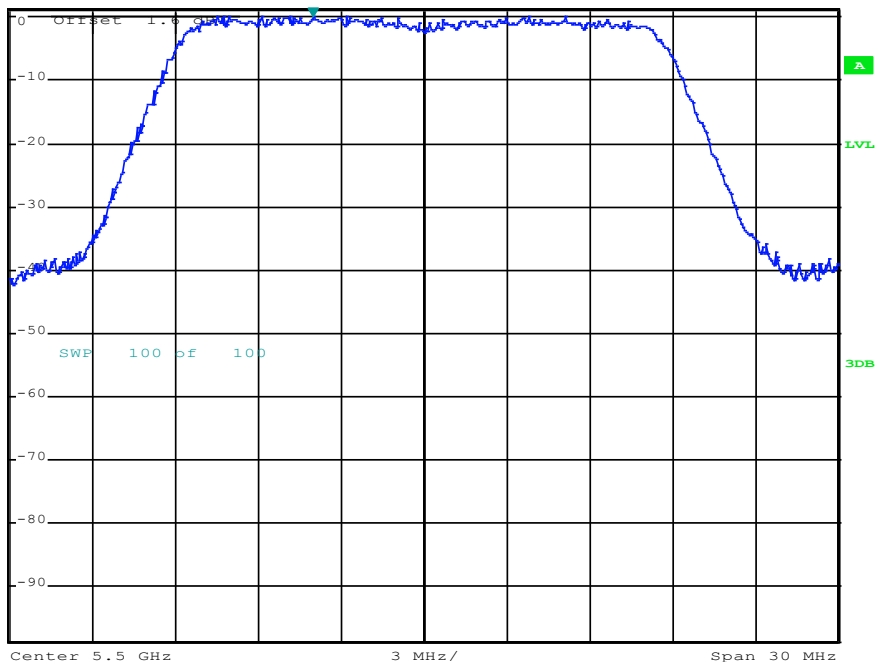


FCC:BV5SMALLENGINE Channel 100 (5500 MHz)



Ref 1 dBm *Att 1 25 dB *RBW 1 MHz Marker 1 [T1]
VBW 3 MHz 0.20 dBm
SWT 20 ms 5.495980000 GHz

1 SA
VIEW

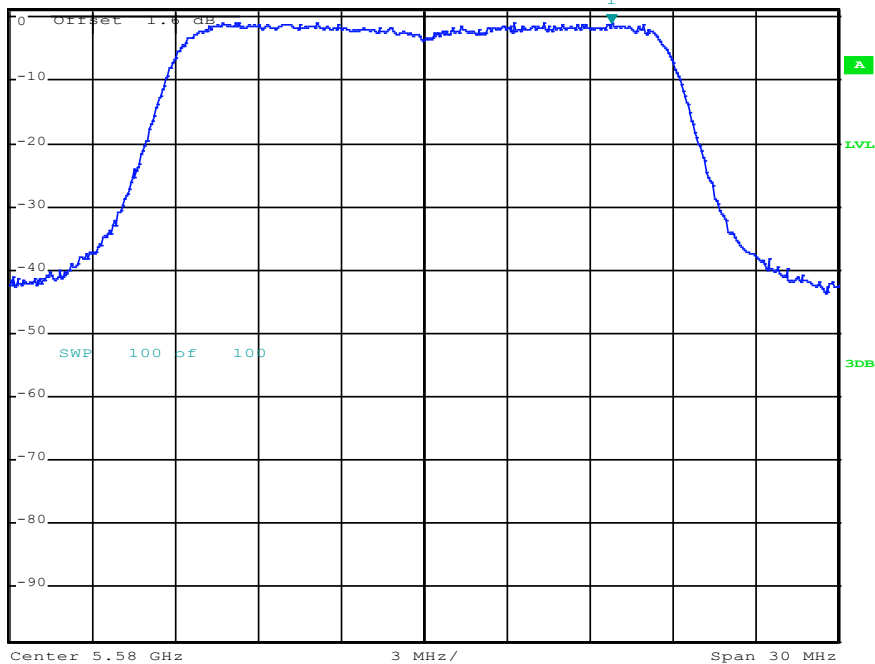


Channel 116 (5580 MHz)

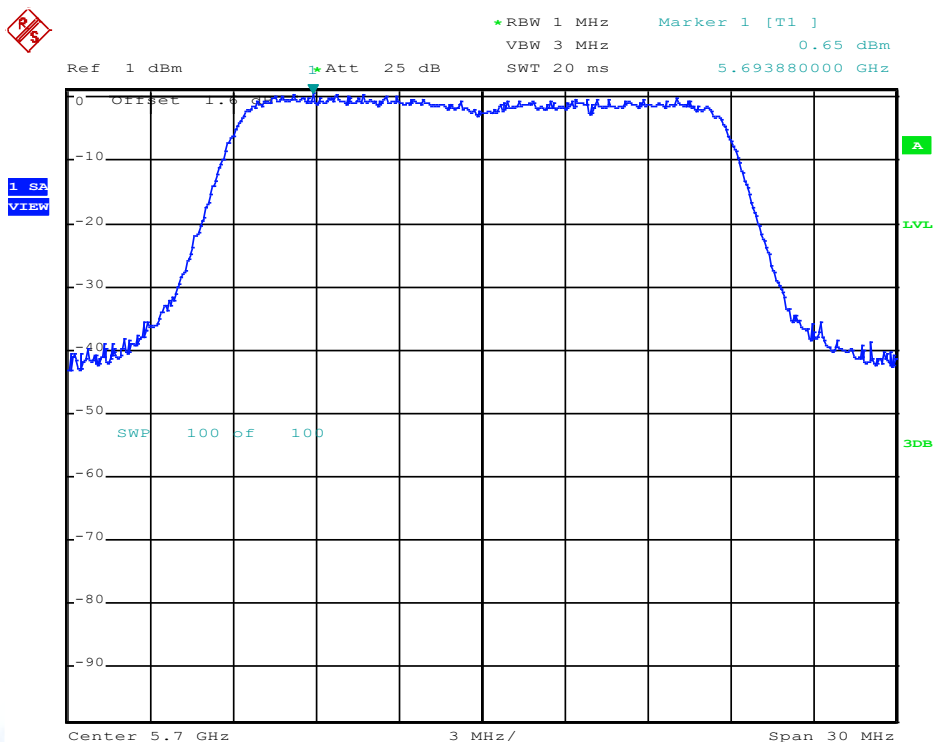


Ref 1 dBm *Att 25 dB *RBW 1 MHz Marker 1 [T1]
VBW 3 MHz -0.88 dBm
SWT 20 ms 5.586780000 GHz

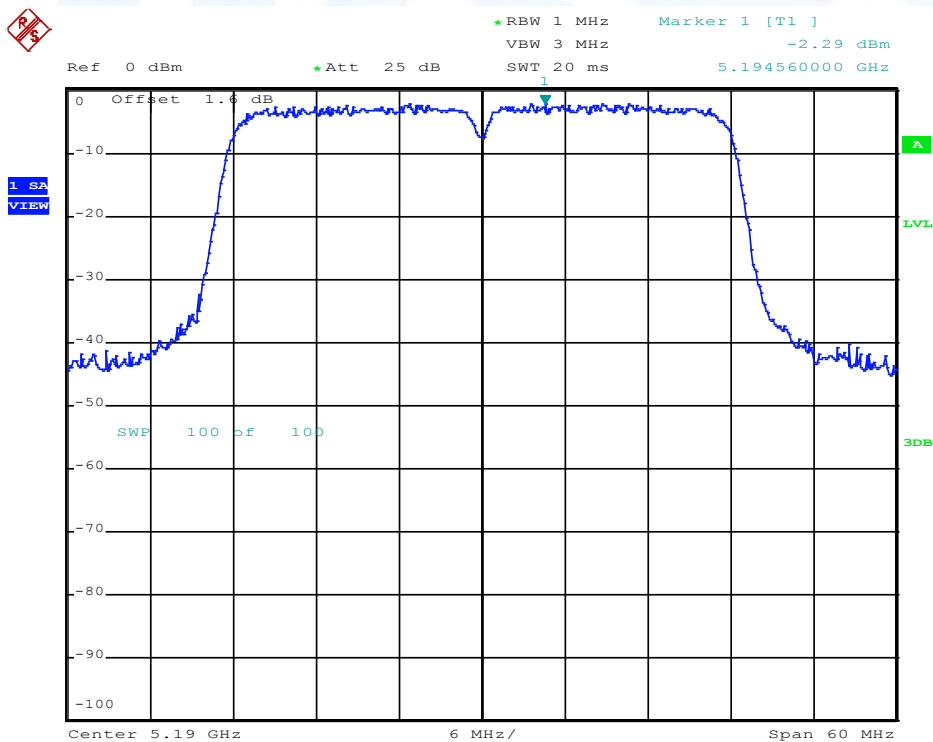
1 SA
VIEW



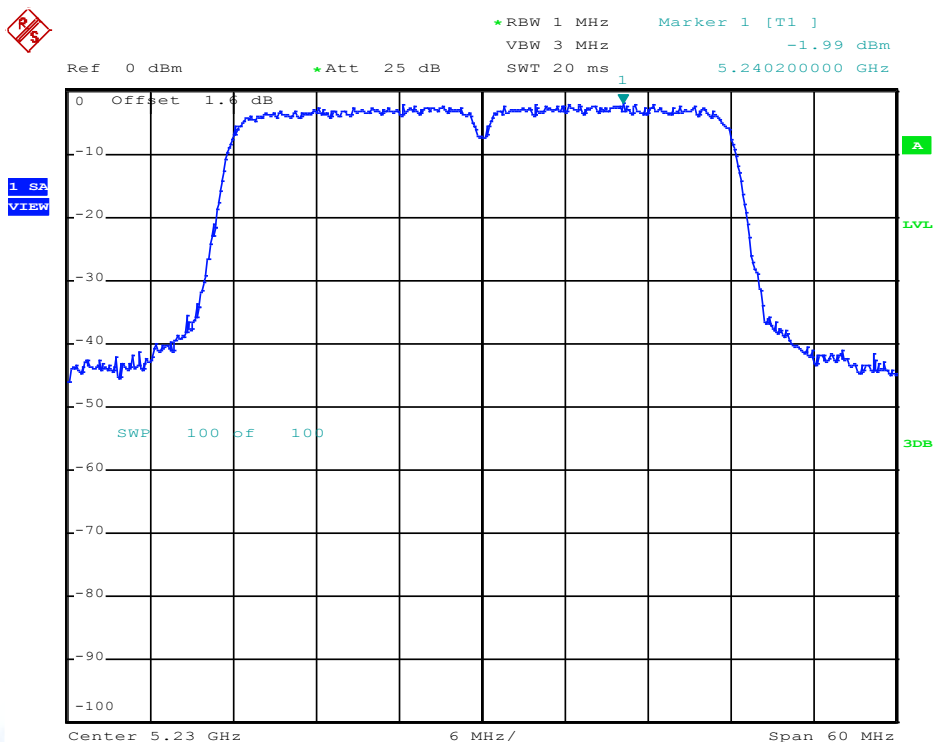
FCC:BV5SMALLENGINE Channel 140 (5700 MHz)



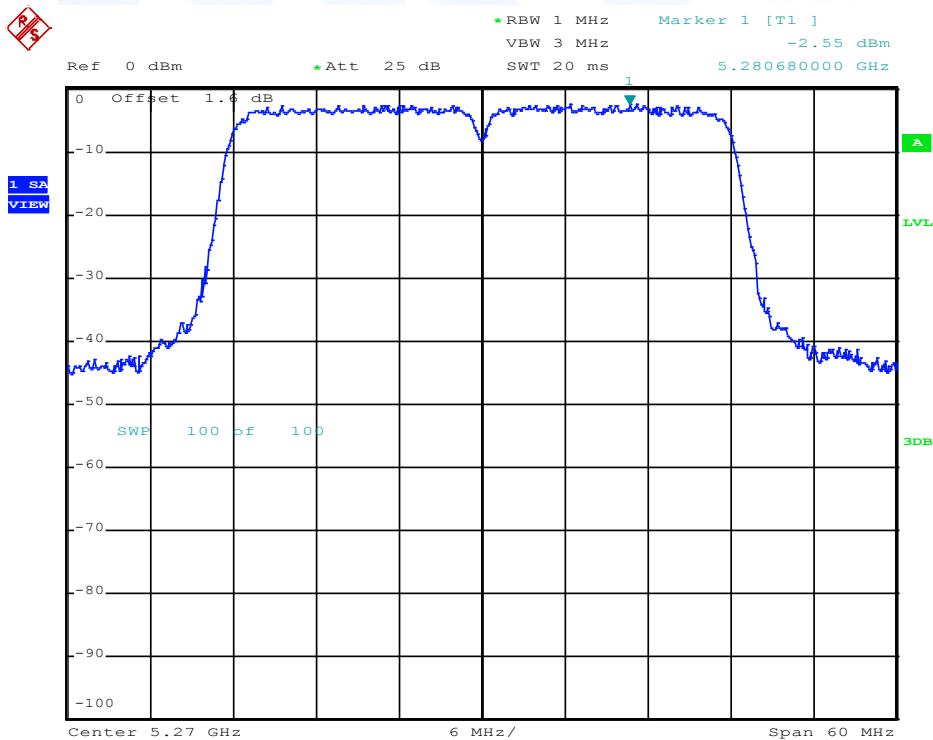
HT40, Ant1: Channel 38 (5190 MHz)



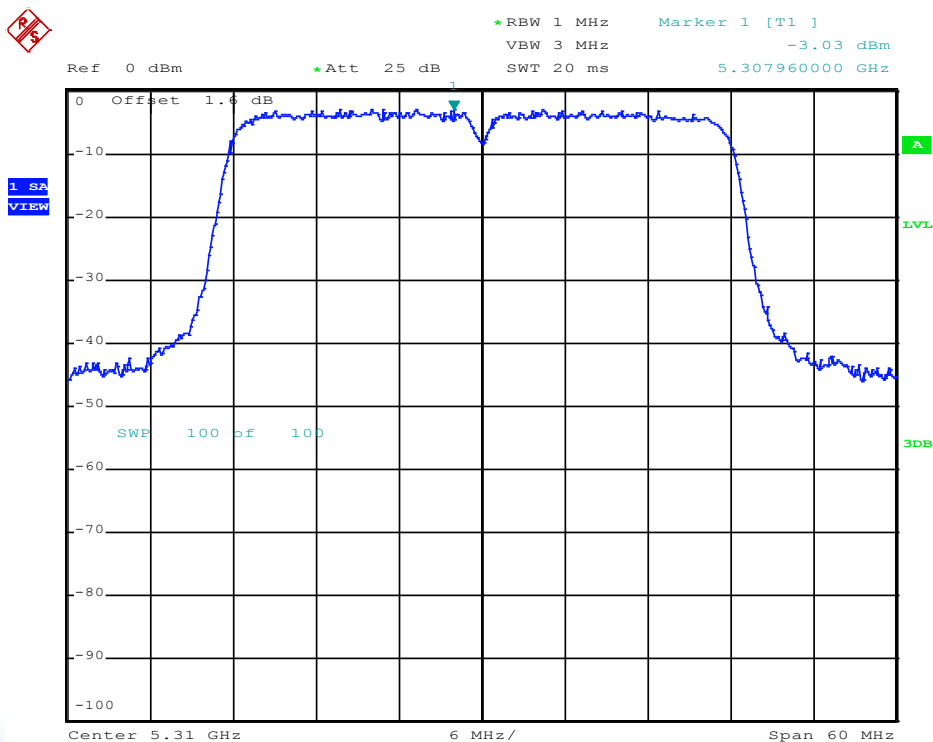
FCC:BV5SMALLENGINE Channel 46 (5230 MHz)



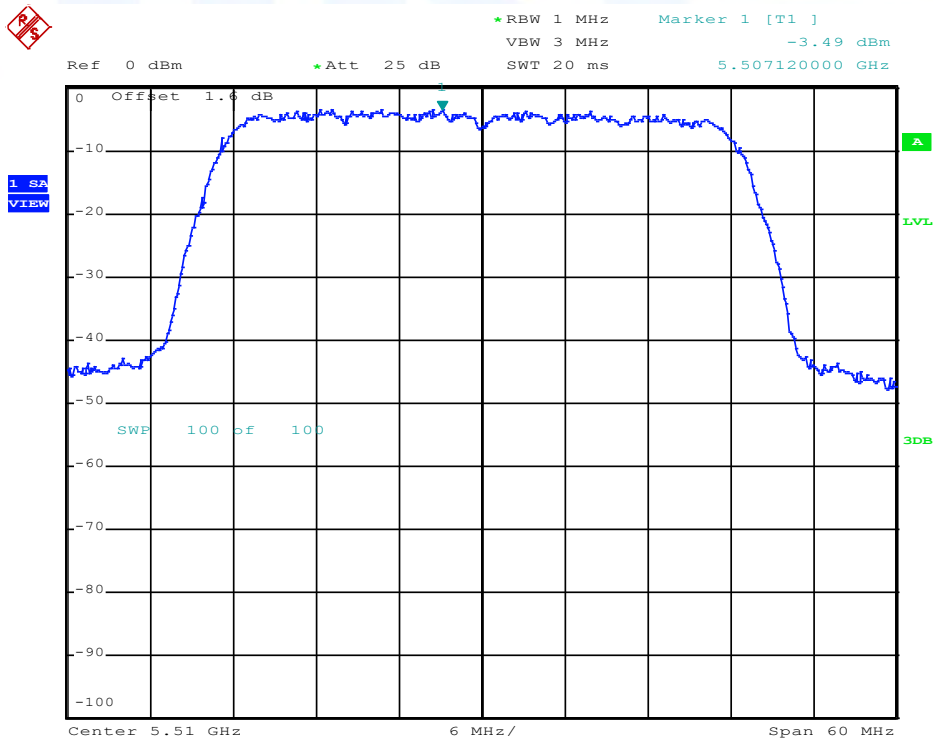
Channel 54 (5270 MHz)



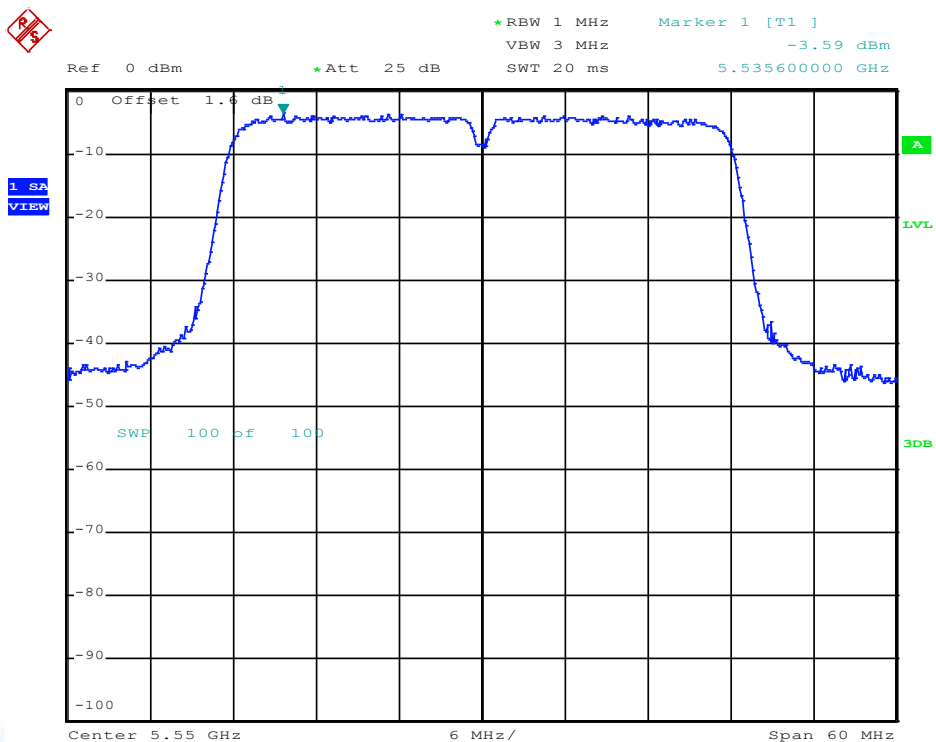
FCC:BV5SMALLENGINE Channel 62 (5310 MHz)



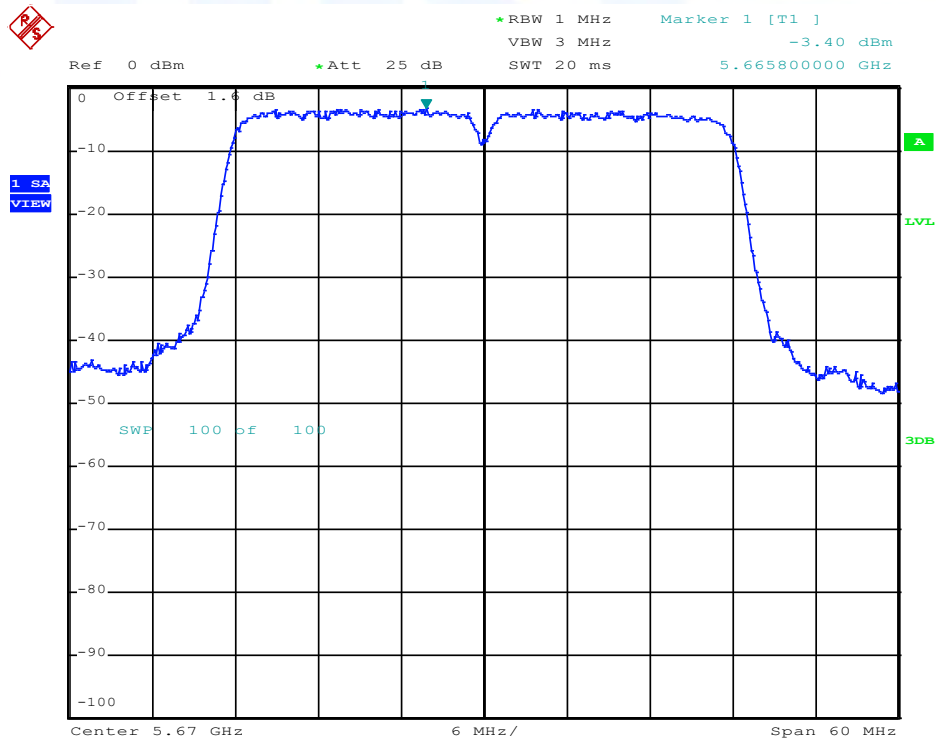
Channel 102 (5510 MHz)



FCC:BV5SMALLENGINE Channel 110 (5550 MHz)



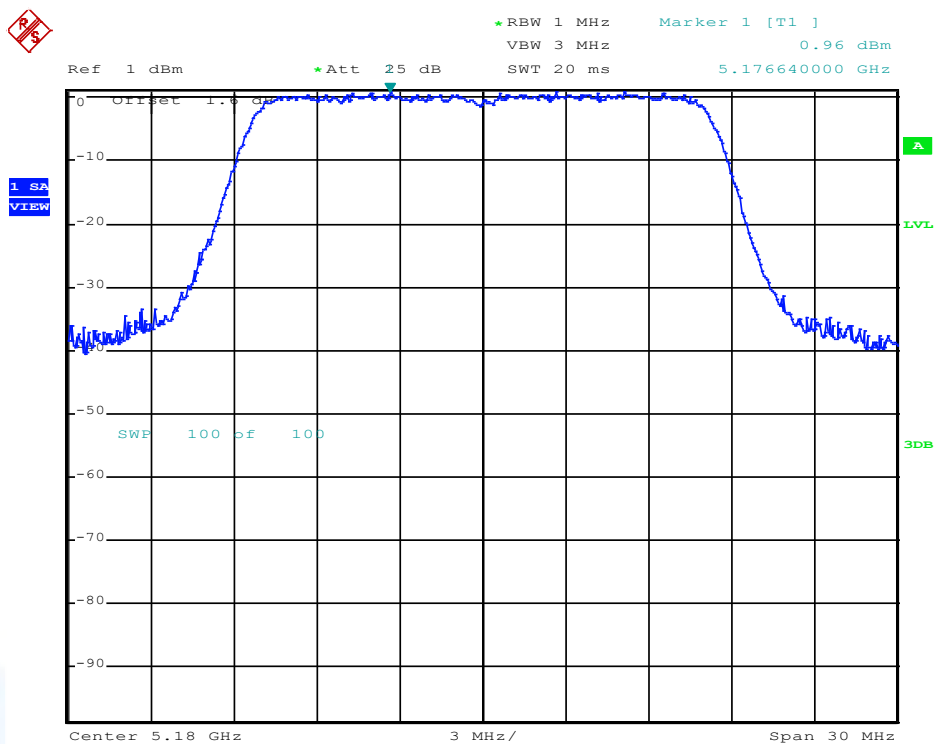
Channel 134 (5670 MHz)



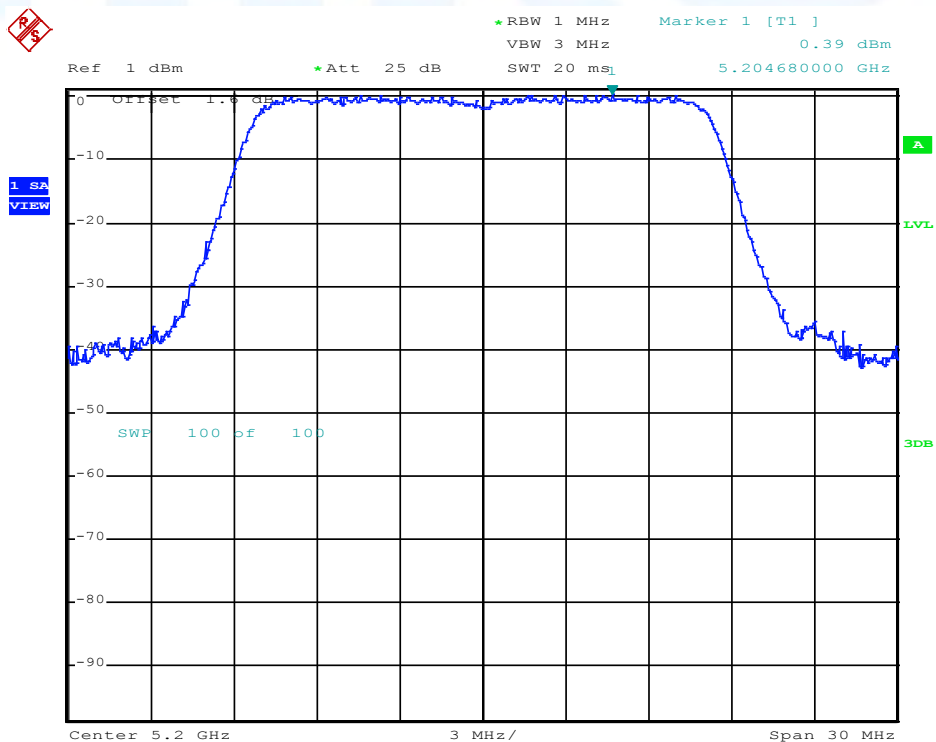
FCC:BV5SMALLENGINE

802.11a, Ant1:

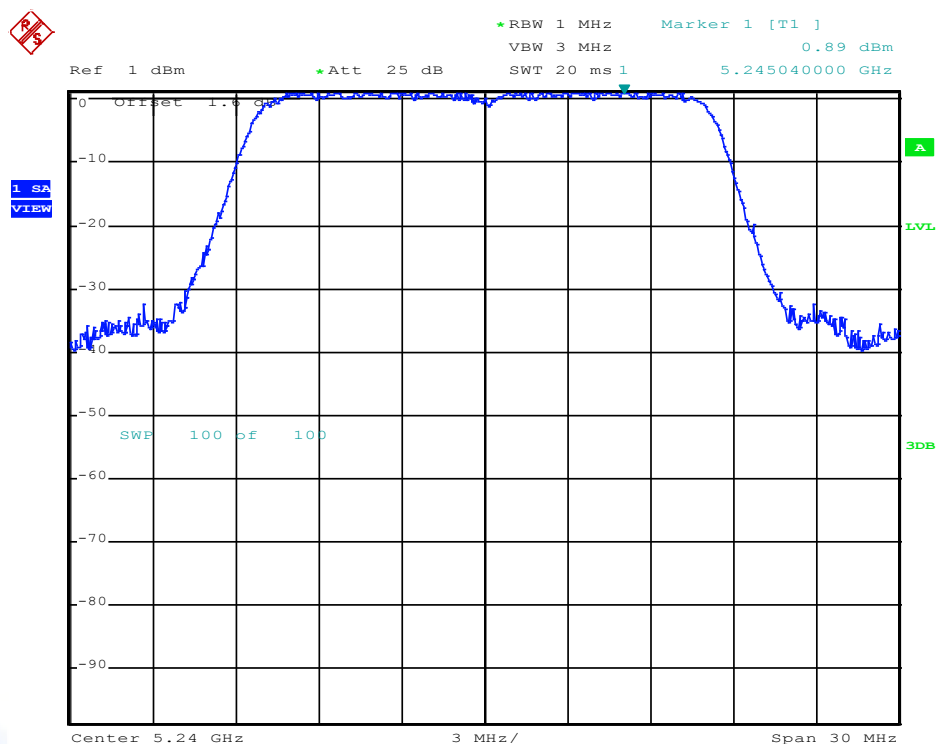
Channel 36 (5180 MHz)



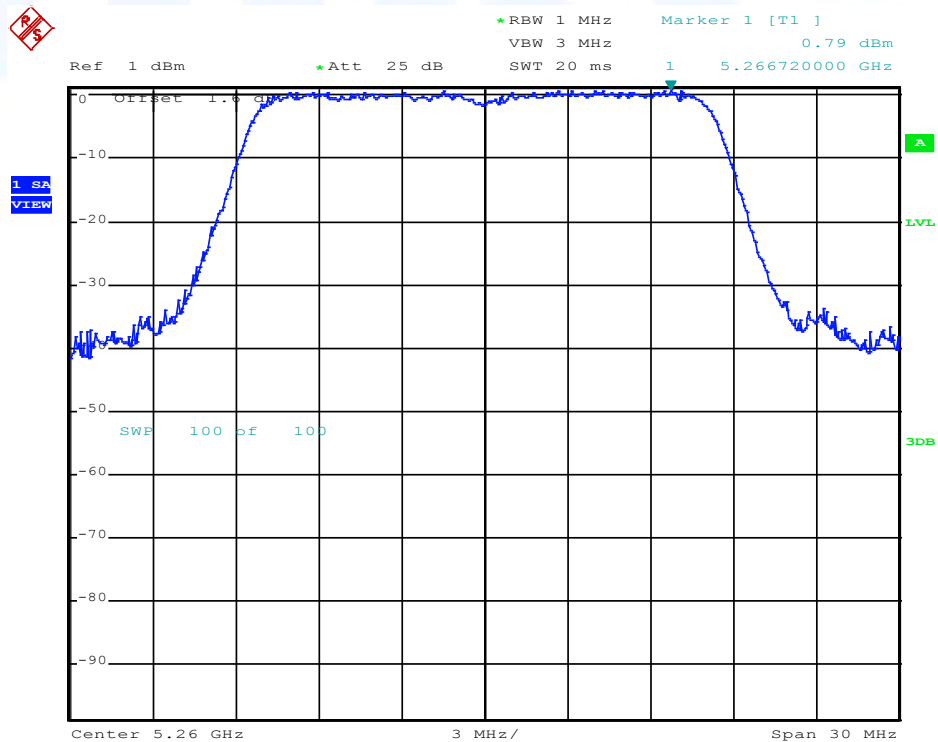
Channel 40 (5200 MHz)



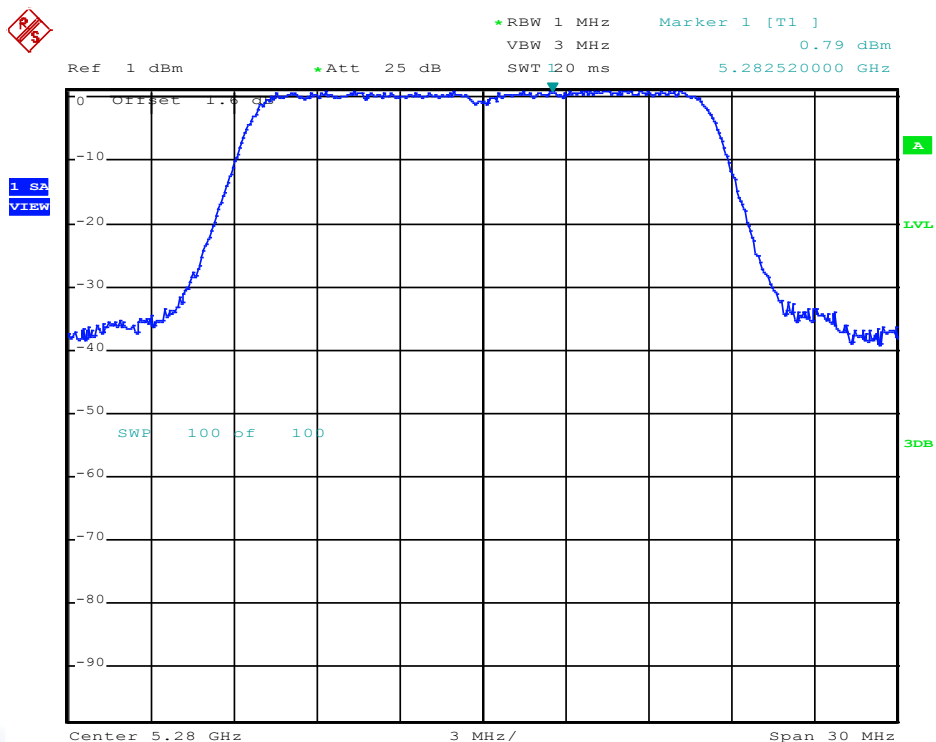
FCC:BV5SMALLENGINE Channel 48 (5240 MHz)



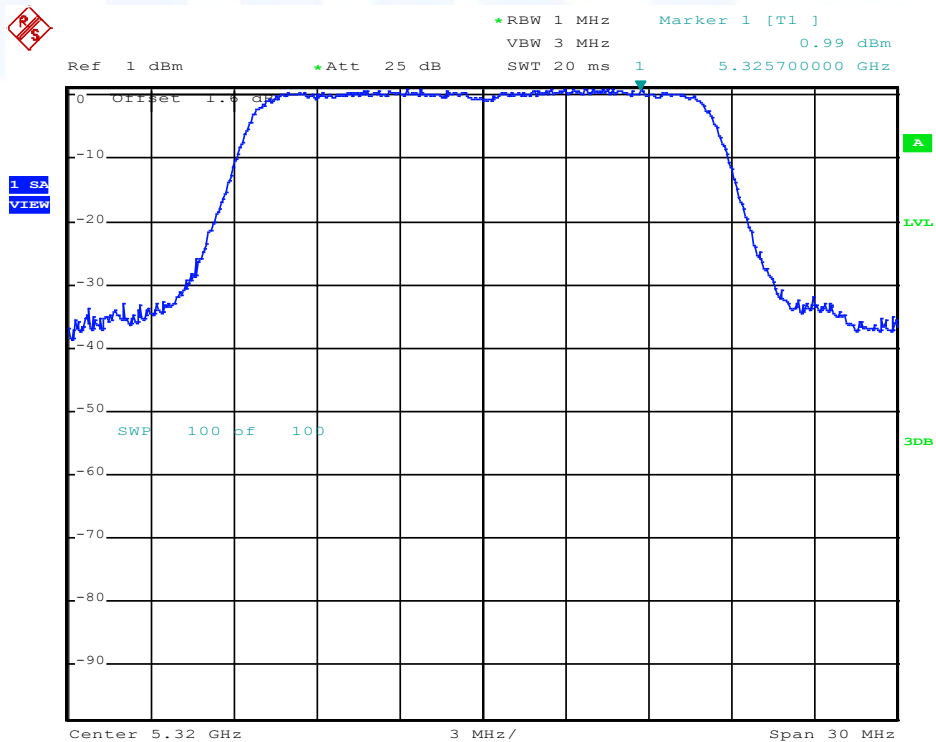
Channel 52 (5260 MHz)



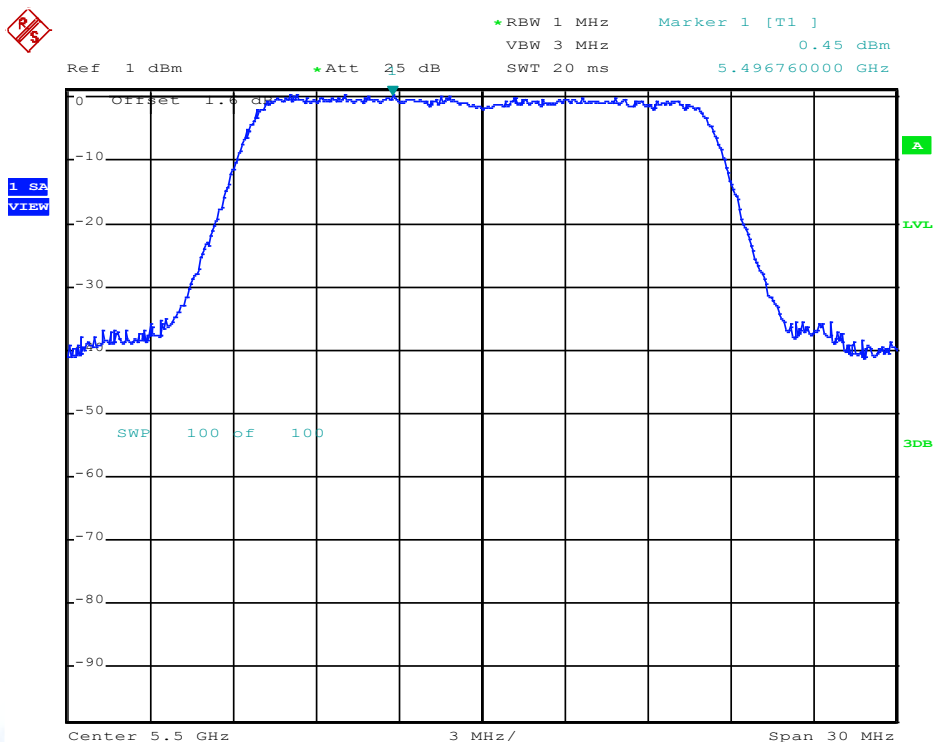
FCC:BV5SMALLENGINE Channel 56 (5280 MHz)



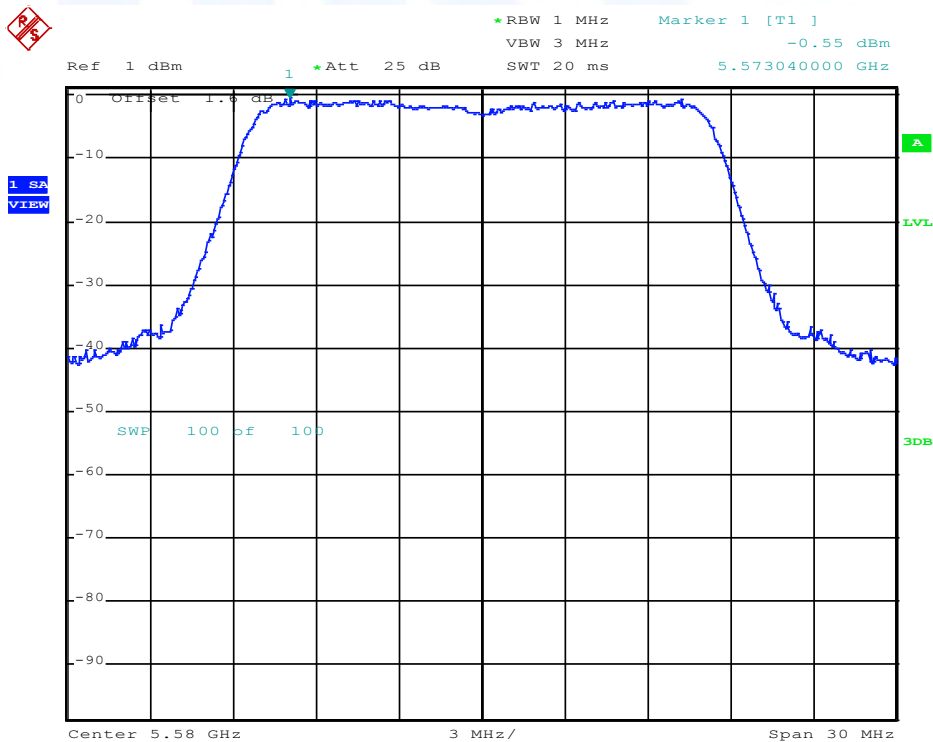
Channel 64 (5320 MHz)



FCC:BV5SMALLENGINE Channel 100 (5500 MHz)



Channel 116 (5580 MHz)



FCC:BV5SMALLENGINE

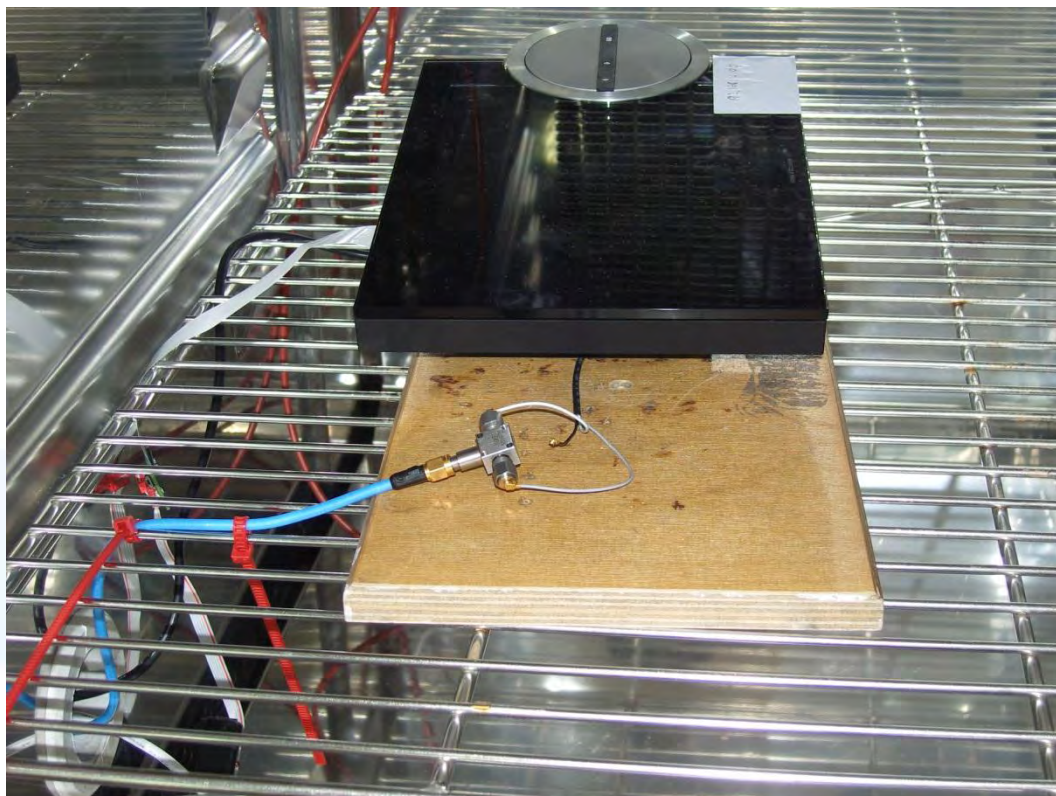
5.5 Peak excursion

For test instruments and accessories used see section 6 Part **MB**.

5.5.1 Description of the test location

Test location: AREA 4

5.5.2 Photo documentation of the test set-up



5.5.3 Applicable standard

According to FCC Part 15E, Section 15.407(a)(6):

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured like before) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

5.5.4 Description of Measurement

The transmitter output was connected to the spectrum analyzer. Using peak detector and "MAX HOLD" function for Trace 1 with 1 MHz RBW and 3 MHz VBW and Trace 2 with 1 MHz RBW and 300 kHz VBW both traces were recorded. The largest difference between Trace 1 and Trace 2 in any 1 MHz band was noted as maximum *Peak Excursion* value.

FCC:BV5SMALLENGINE

5.5.5 Test result
HT20, Ant1:

Channel	Frequency (MHz)	Power setting	Peak power excursion (dBm)	Peak to average excursion limit (dBm)	Delta (dB)
36	5180	3, 5	9.0	13.0	-4.0
40	5200	2, 4	8.6	13.0	-4.4
48	5240	2, 3	8.8	13.0	-4.2
52	5260	1, 2	10.0	13.0	-3.0
56	5280	1, 2	8.7	13.0	-4.3
64	5320	1, 0	8.8	13.0	-4.2
100	5500	0, 0	8.7	13.0	-4.3
116	5580	0, -1	9.1	13.0	-3.9
140	5700	2,2	9.1	13.0	-3.9

HT20, Ant2:

Channel	Frequency (MHz)	Power setting	Peak power excursion (dBm)	Peak to average excursion limit (dBm)	Delta (dB)
36	5180	5	4.9	13.0	-7.1
40	5200	4	4.9	13.0	-7.1
48	5240	3	7.4	13.0	-5.6
52	5260	2	7.8	13.0	-5.2
56	5280	2	8.3	13.0	-4.7
64	5320	0	7.7	13.0	-5.3
100	5500	0	7.9	13.0	-5.1
116	5580	1	7.3	13.0	-5.7
140	5700	2	7.4	13.0	-5.6

HT40, Ant1:

Channel	Frequency (MHz)	Power setting	Peak power excursion (dBm)	Peak to average excursion limit (dBm)	Delta (dB)
38	5190	3	8.5	13.0	-4.5
46	5230	2	8.3	13.0	-4.7
54	5270	1	9.1	13.0	-3.9
62	5310	0	8.8	13.0	-4.2
102	5510	0	7.9	13.0	-5.1
110	5550	0	7.3	13.0	-5.7
134	5670	2	9.1	13.0	-3.9

HT40, Ant2:

Channel	Frequency (MHz)	Power setting	Peak power excursion (dBm)	Peak to average excursion limit (dBm)	Delta (dB)
38	5190	5	8.4	13.0	-4.6
46	5230	3	9.1	13.0	-3.9
54	5270	2	9.1	13.0	-3.9
62	5310	2	8.3	13.0	-4.7
102	5510	-2	9.3	13.0	-3.7
110	5550	-2	8.7	13.0	-4.3
134	5670	1	9.1	13.0	-3.9

FCC:BV5SMALLENGINE

802.11a, Ant1:

Channel	Frequency (MHz)	Power setting	Peak power excursion (dBm)	Peak to average excursion limit (dBm)	Delta (dB)
36	5180	3	8.0	13.0	-5.0
40	5200	2	8.0	13.0	-5.0
48	5240	2	7.6	13.0	-5.4
52	5260	1	8.3	13.0	-4.7
56	5280	1	7.9	13.0	-5.1
64	5320	1	7.7	13.0	-5.3
100	5500	0	7.9	13.0	-5.1
116	5580	0	7.9	13.0	-5.1
140	5700	2	8.0	13.0	-5.0

802.11a, Ant2:

Channel	Frequency (MHz)	Power setting	Peak power excursion (dBm)	Peak to average excursion limit (dBm)	Delta (dB)
36	5180	5	8.1	13.0	-4.9
40	5200	4	8.6	13.0	-4.4
48	5240	3	8.2	13.0	-5.4
52	5260	2	7.9	13.0	-4.7
56	5280	2	8.5	13.0	-5.1
64	5320	0	7.8	13.0	-5.3
100	5500	0	7.7	13.0	-5.1
116	5580	1	7.7	13.0	-5.1
140	5700	2	8.0	13.0	-5.0

The requirements are **FULFILLED**.

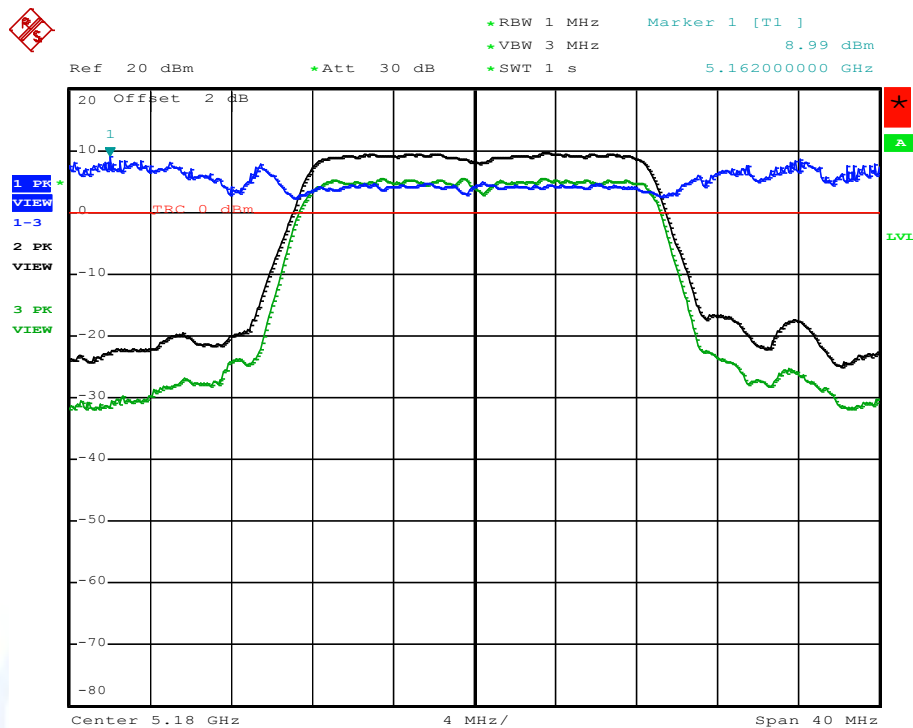
Remarks: For detailed test results please see the following test protocols. Only the worst case of the plots
are listed.

FCC:BV5SMALLENGINE

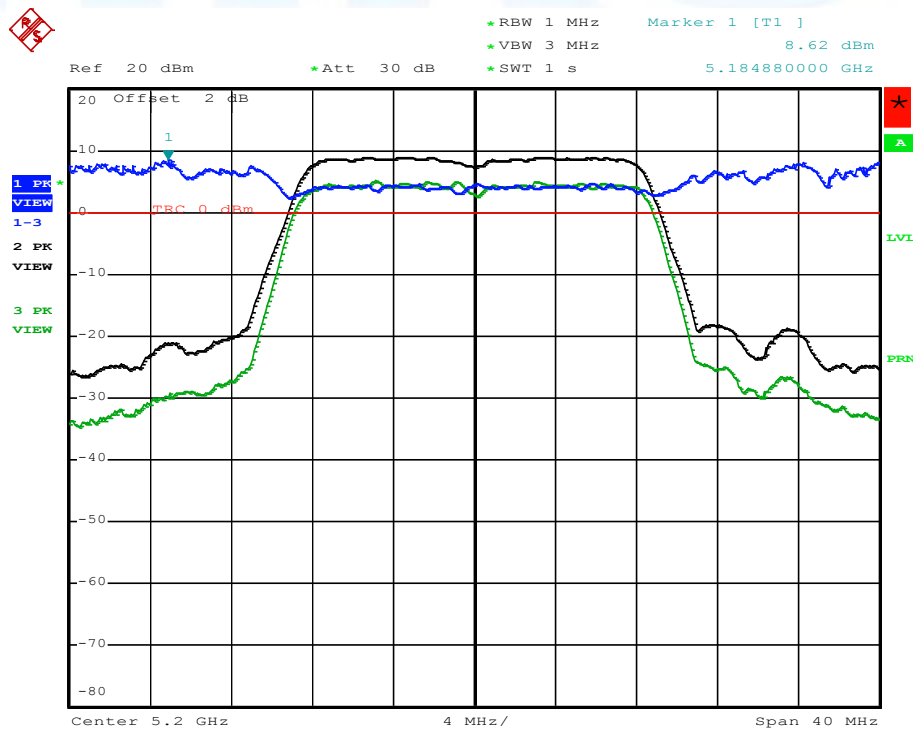
5.5.5.1 Peak excursion plots

HT20, Ant1

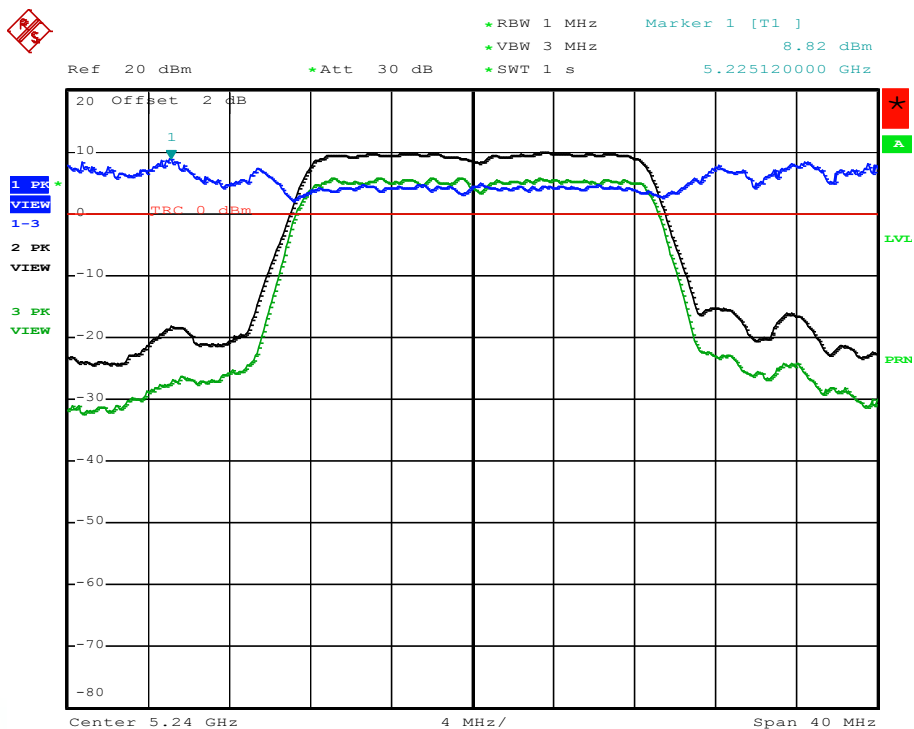
Channel 36 (5180 MHz)



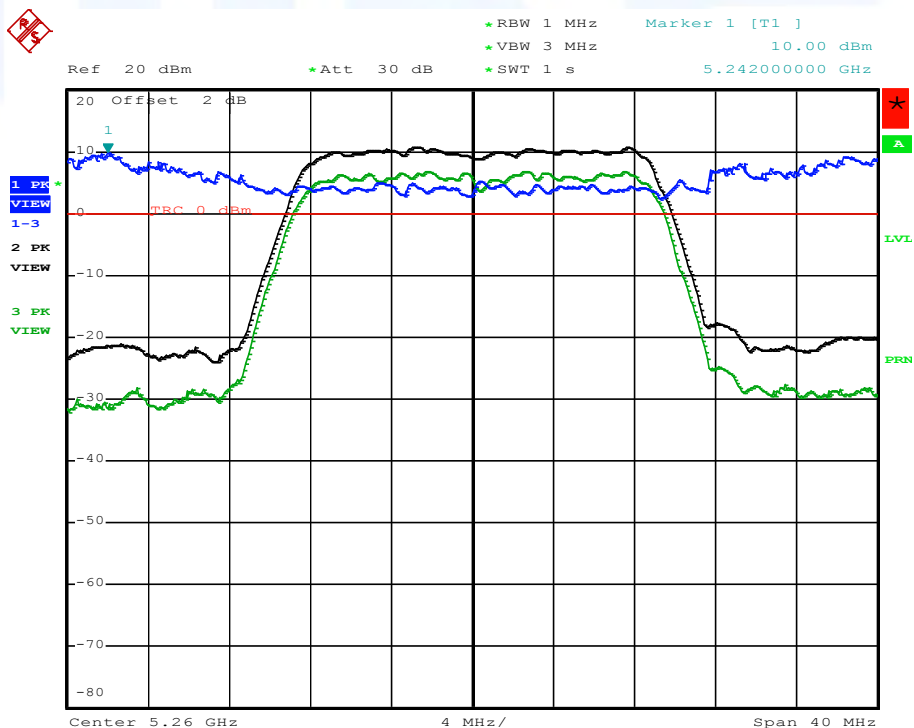
Channel 40 (5200 MHz)



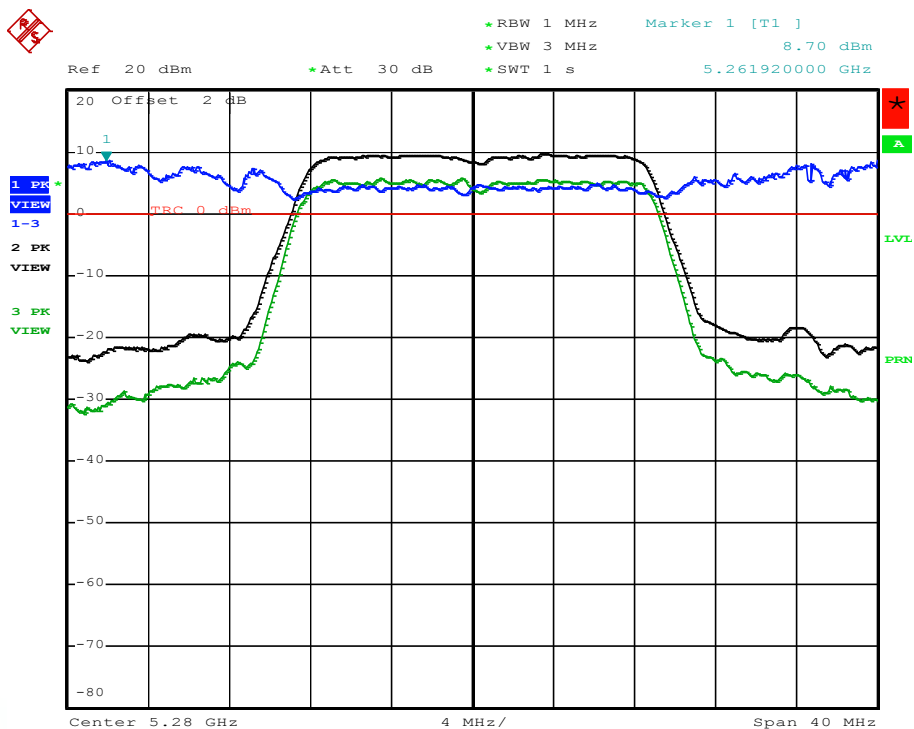
FCC:BV5SMALLENGINE Channel 48 (5240 MHz)



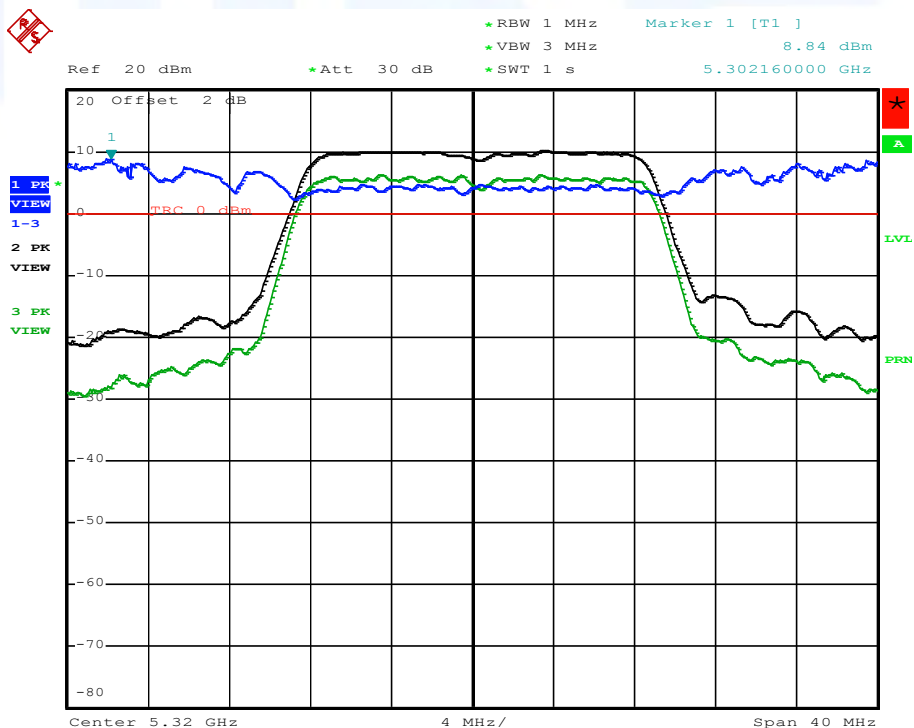
Channel 52 (5260 MHz)



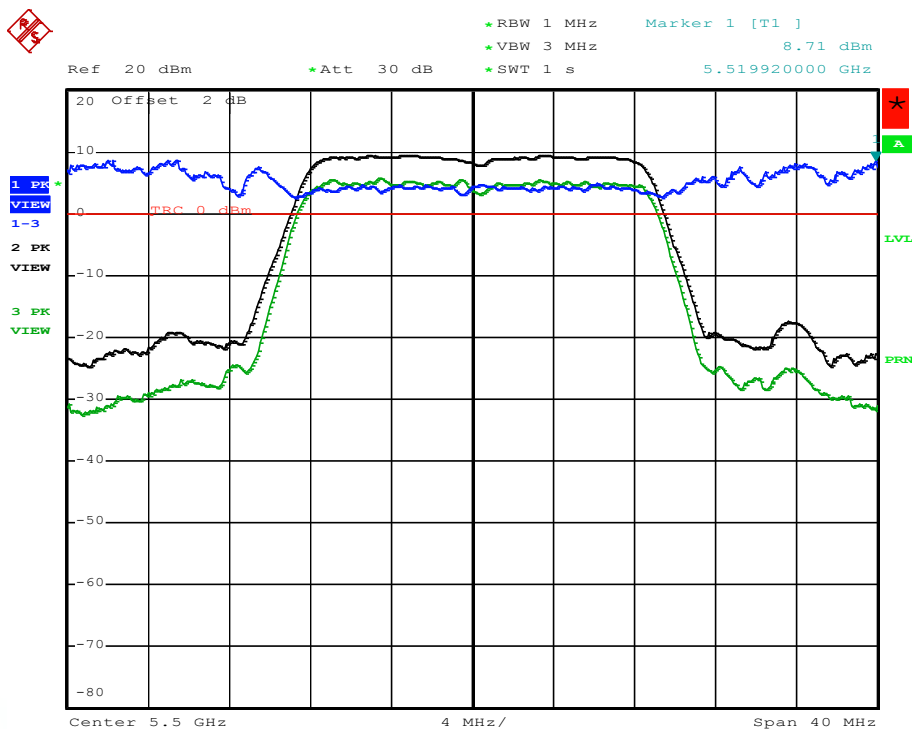
FCC:BV5SMALLENGINE Channel 56 (5280 MHz)



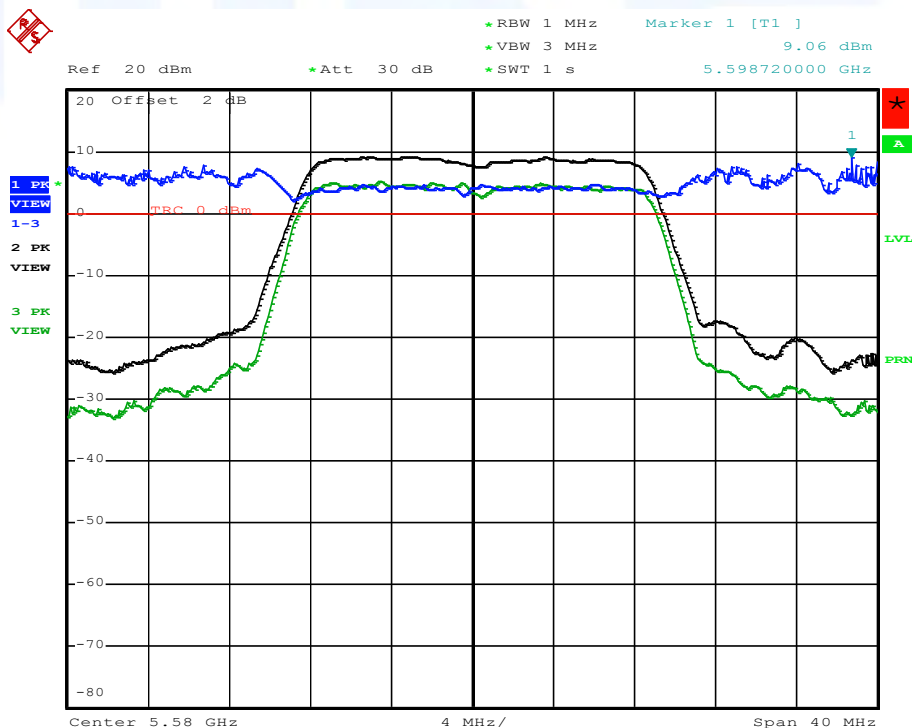
Channel 64 (5320 MHz)



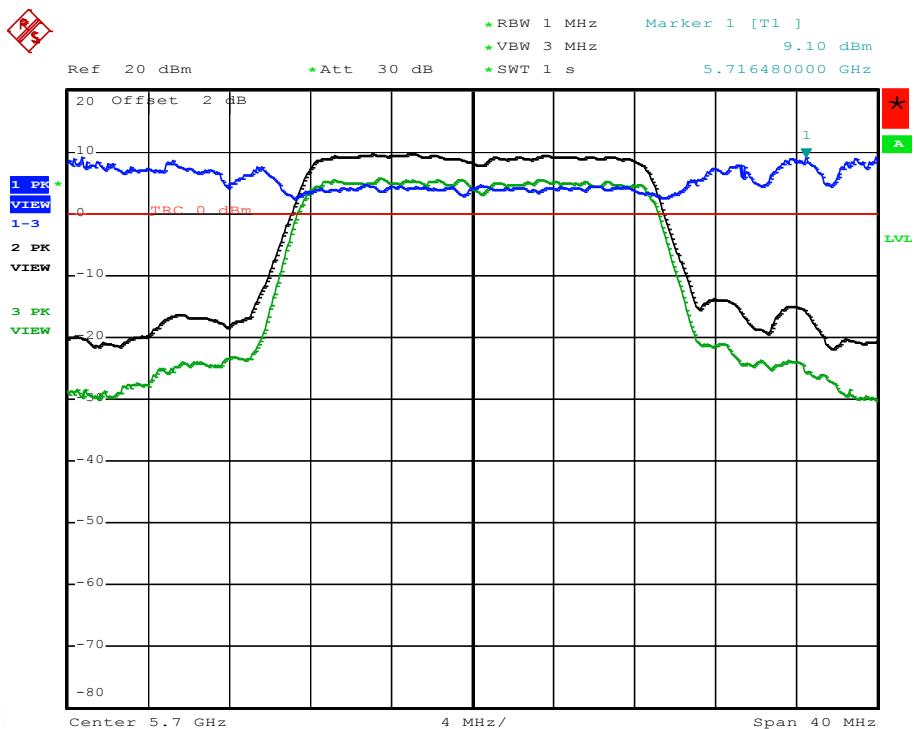
FCC:BV5SMALLENGINE Channel 100 (5500 MHz)



Channel 116 (5580 MHz)

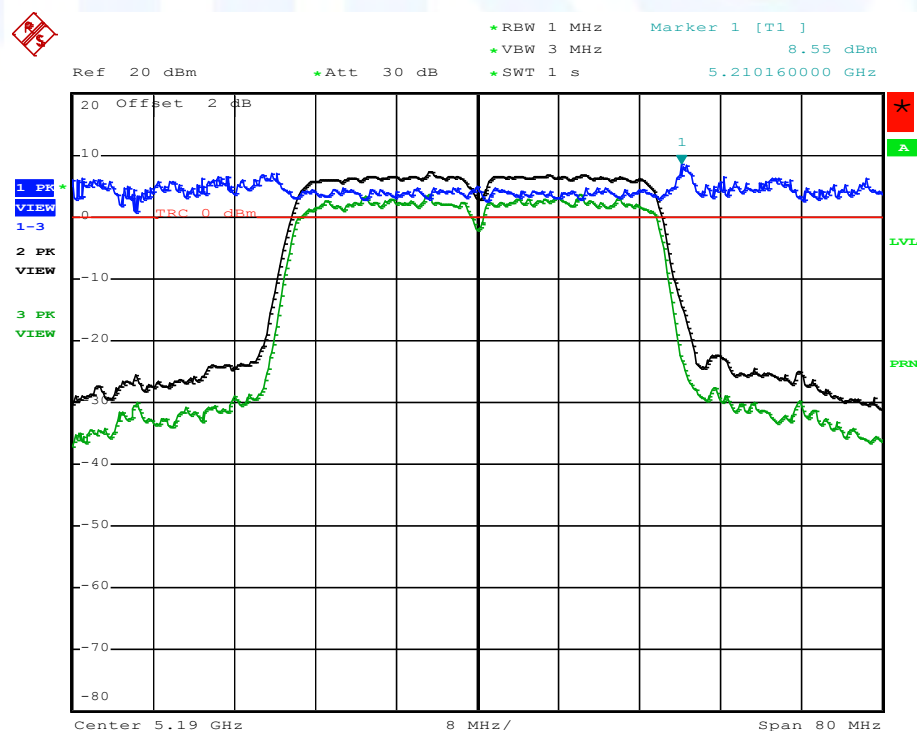


FCC:BV5SMALLENGINE Channel 140 (5700 MHz)

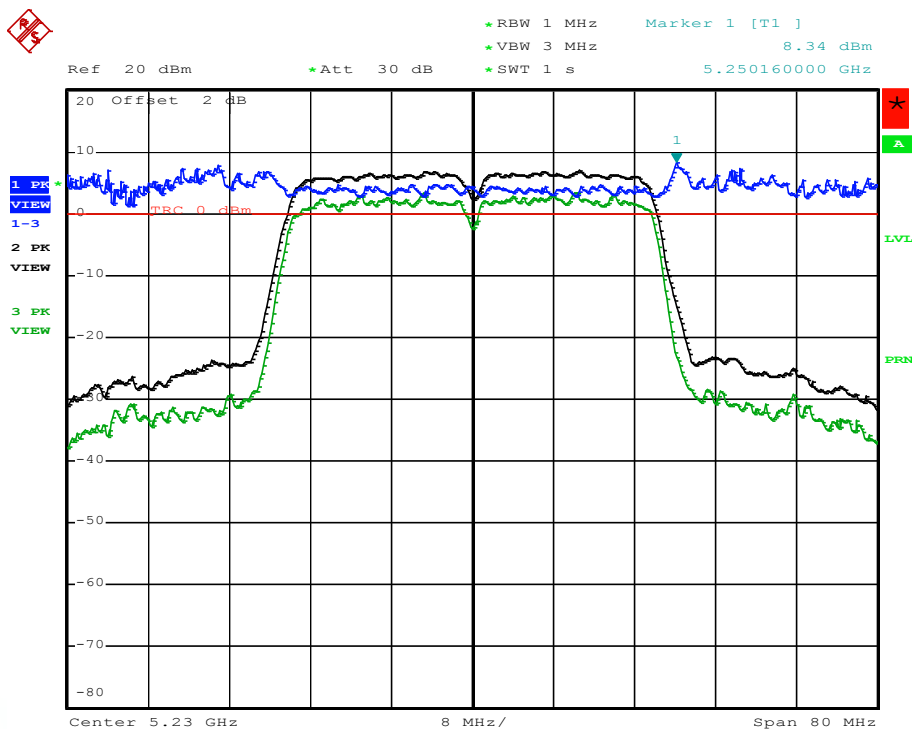


HT40, Ant1

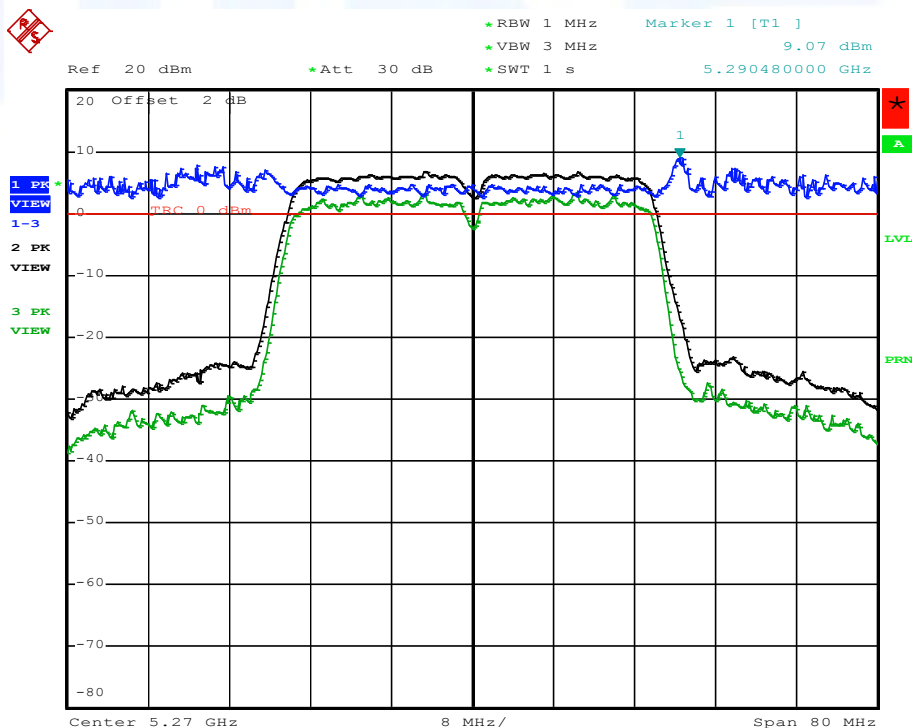
Channel 38 (5190 MHz)



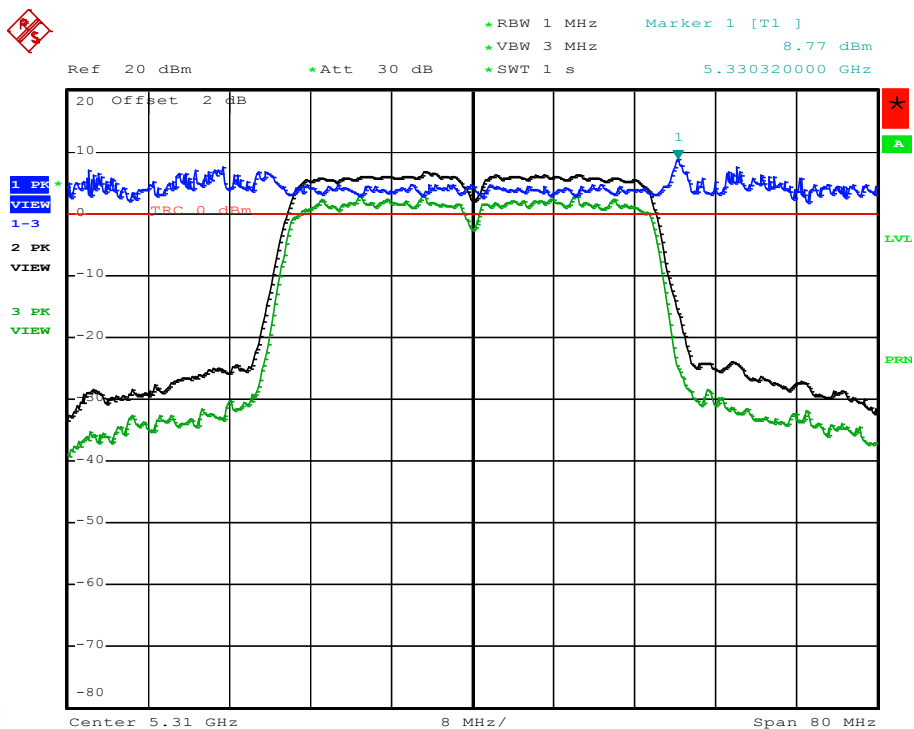
FCC:BV5SMALLENGINE Channel 46 (5230 MHz)



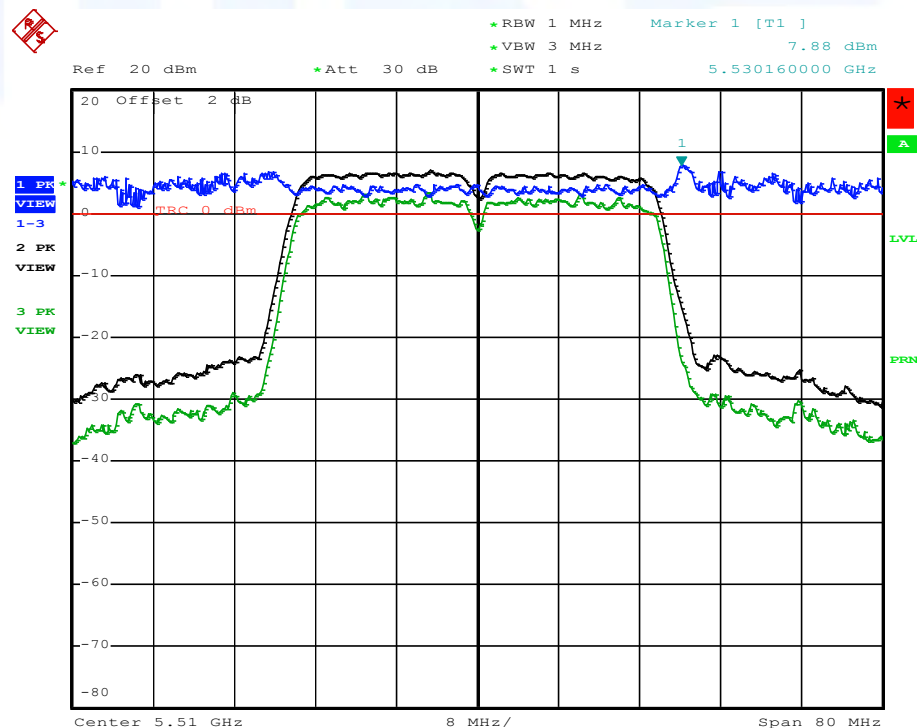
Channel 54 (5270 MHz)



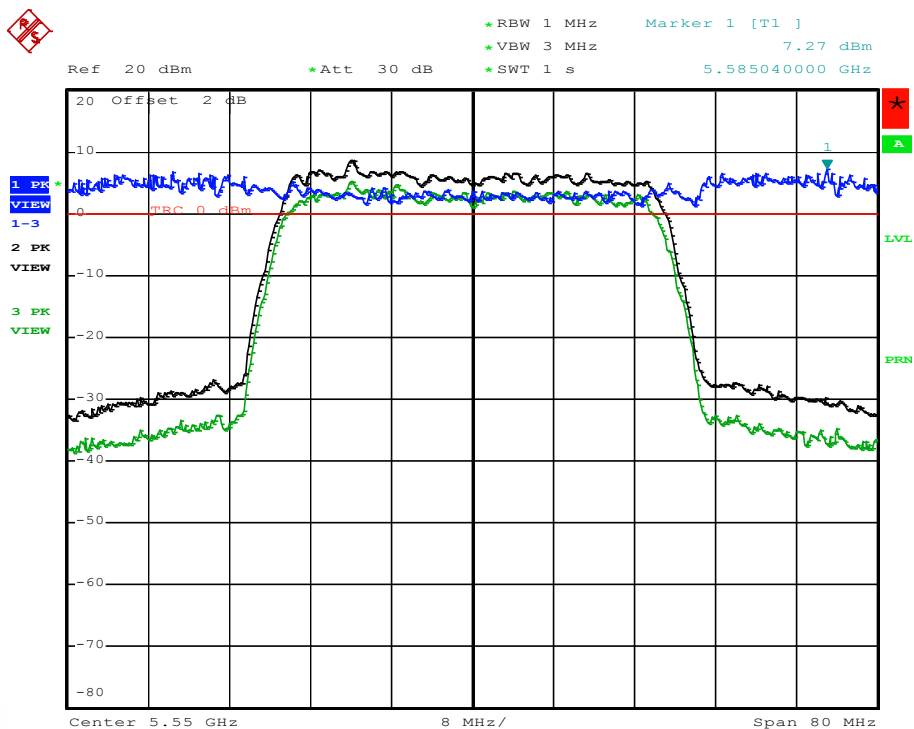
FCC:BV5SMALLENGINE Channel 62 (5310 MHz)



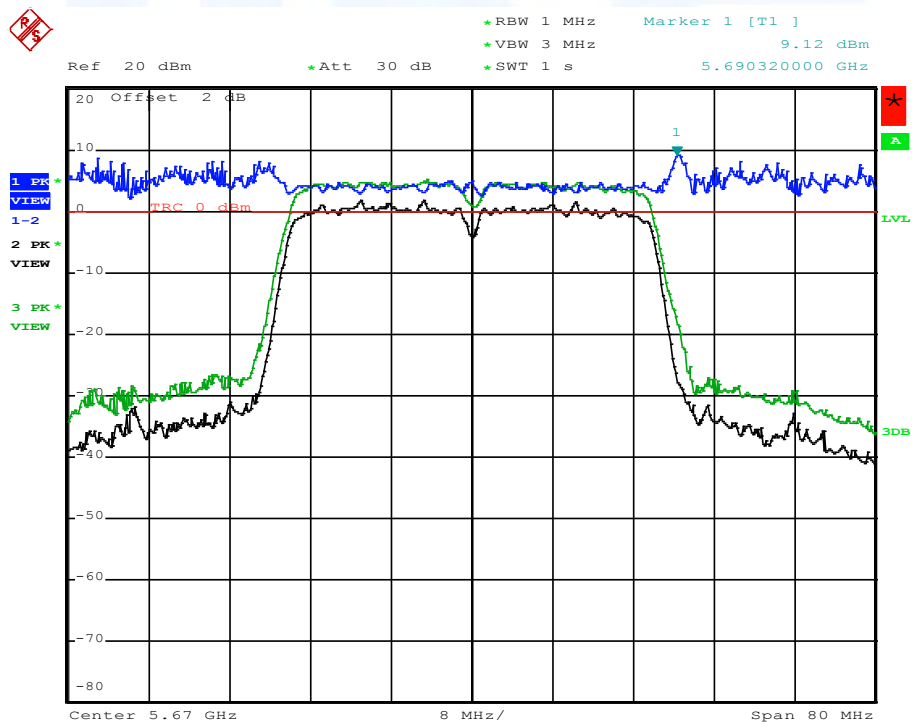
Channel 102 (5510 MHz)



FCC:BV5SMALLENGINE Channel 110 (5550 MHz)

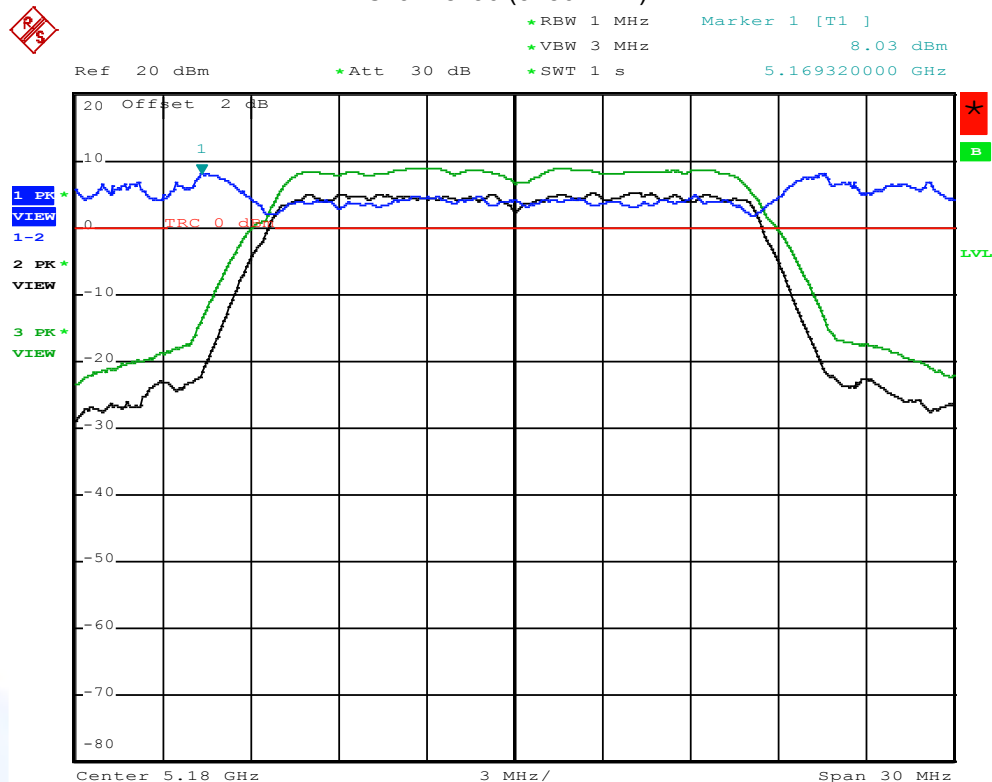


Channel 134 (5670 MHz)

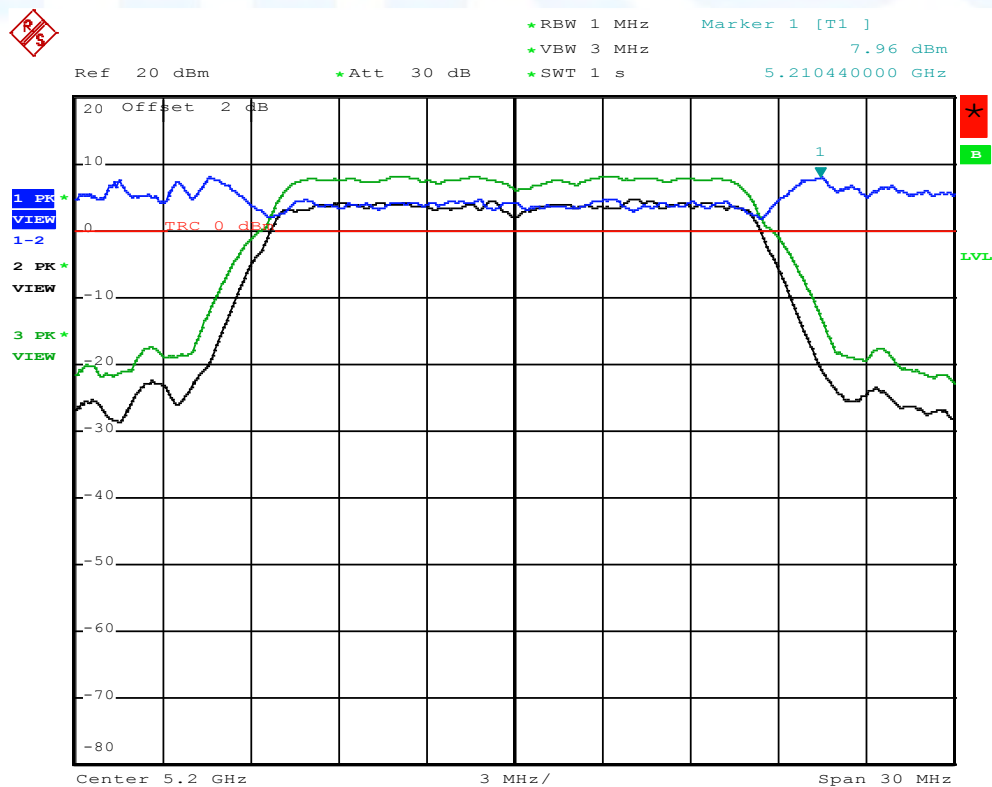


FCC:BV5SMALLENGINE
802.11a, Ant1:

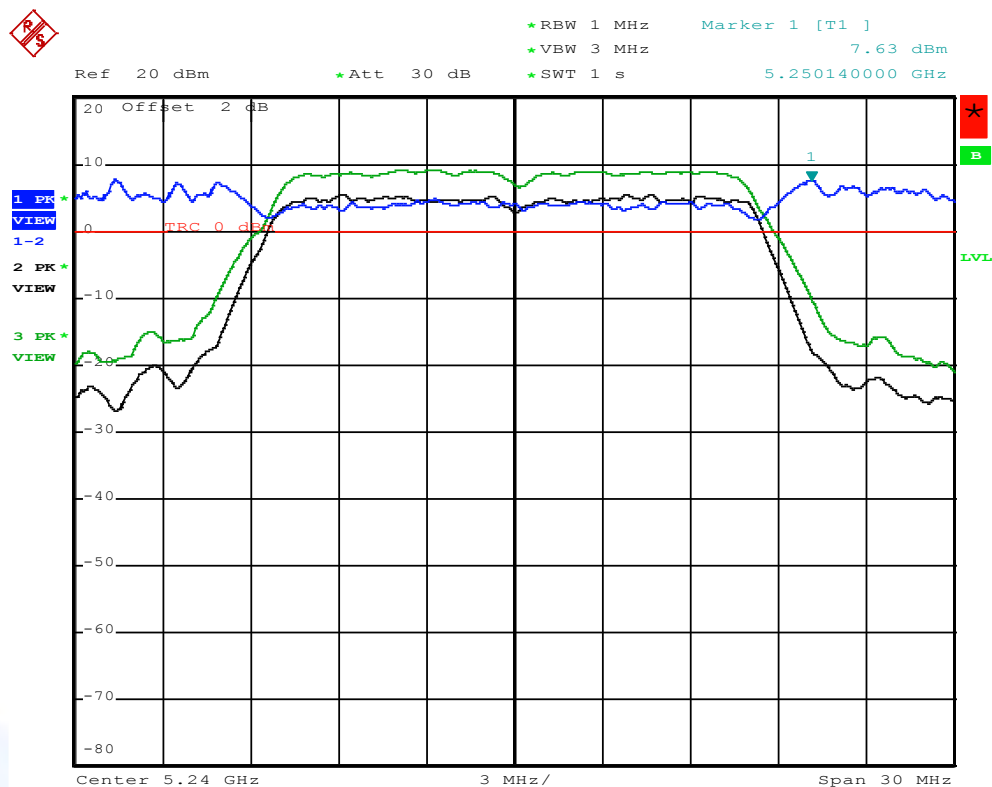
Channel 36 (5180 MHz)



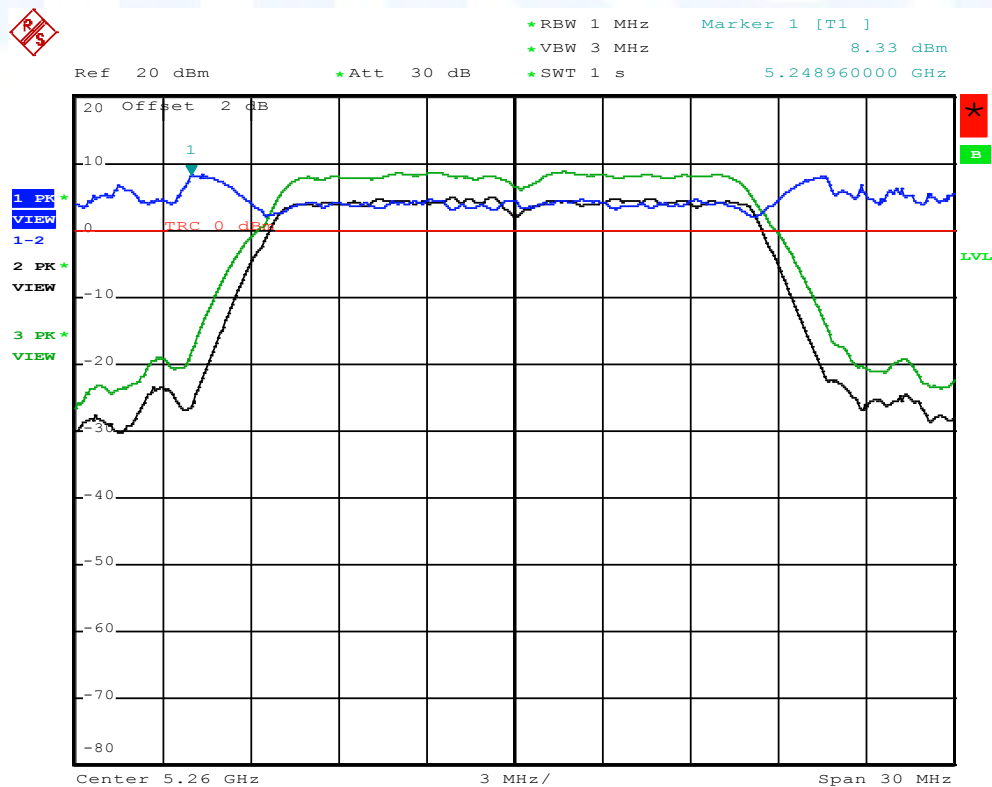
Channel 40 (5200 MHz)



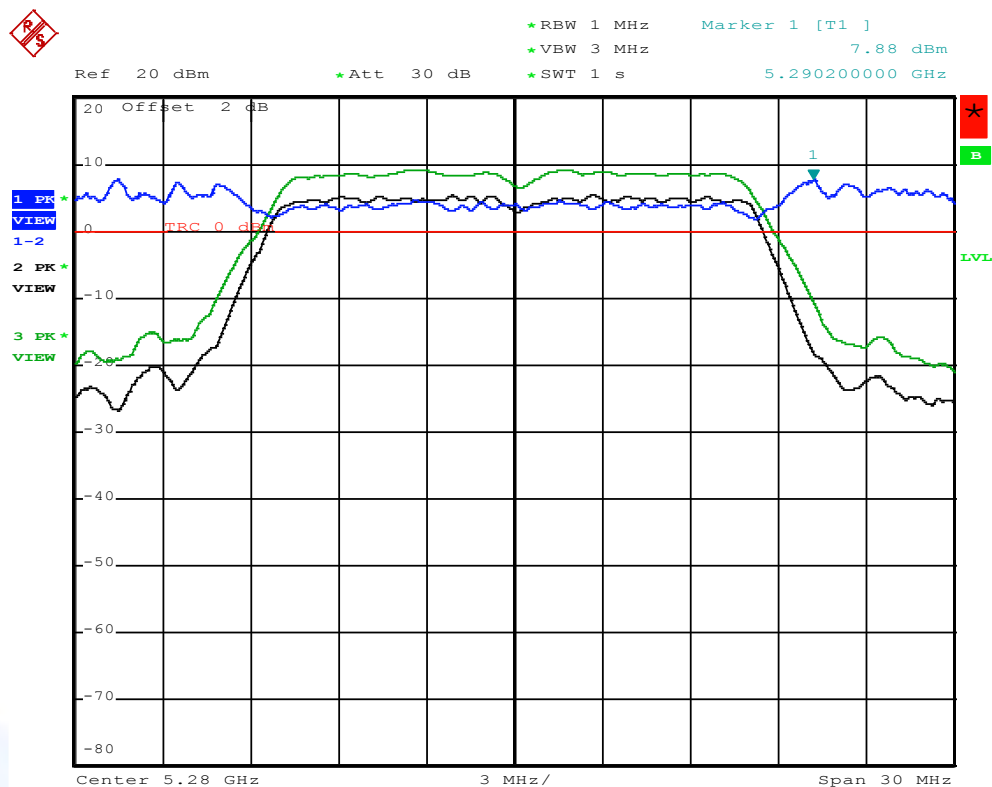
FCC:BV5SMALLENGINE Channel 48 (5240 MHz)



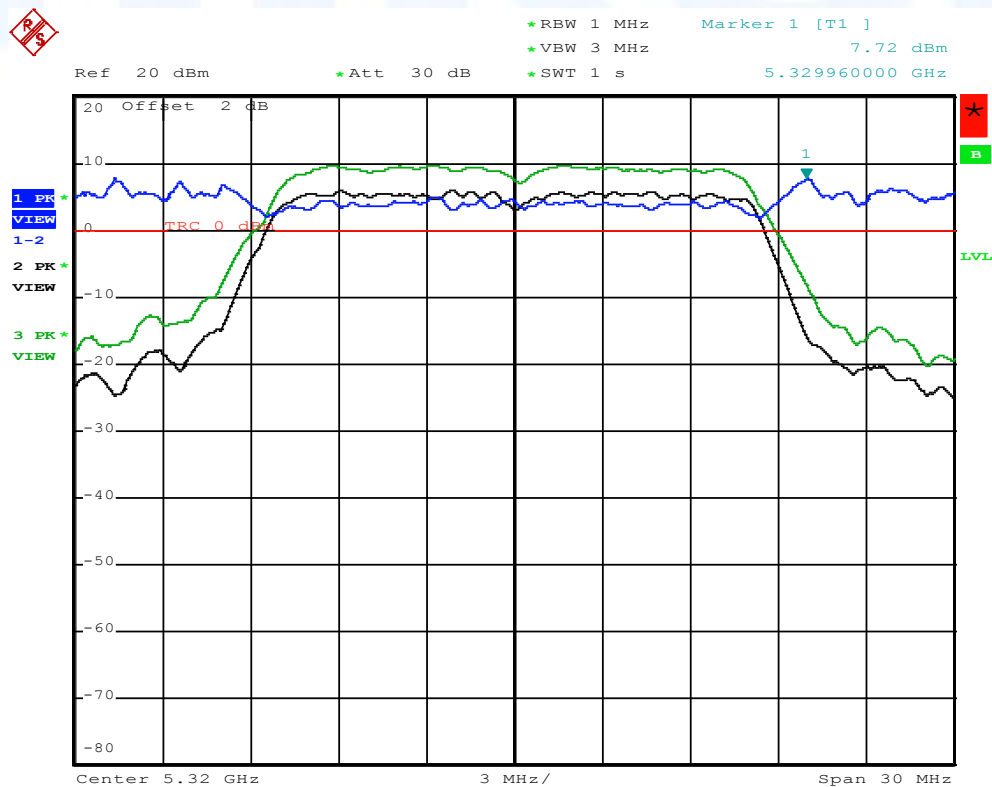
Channel 52 (5260 MHz)



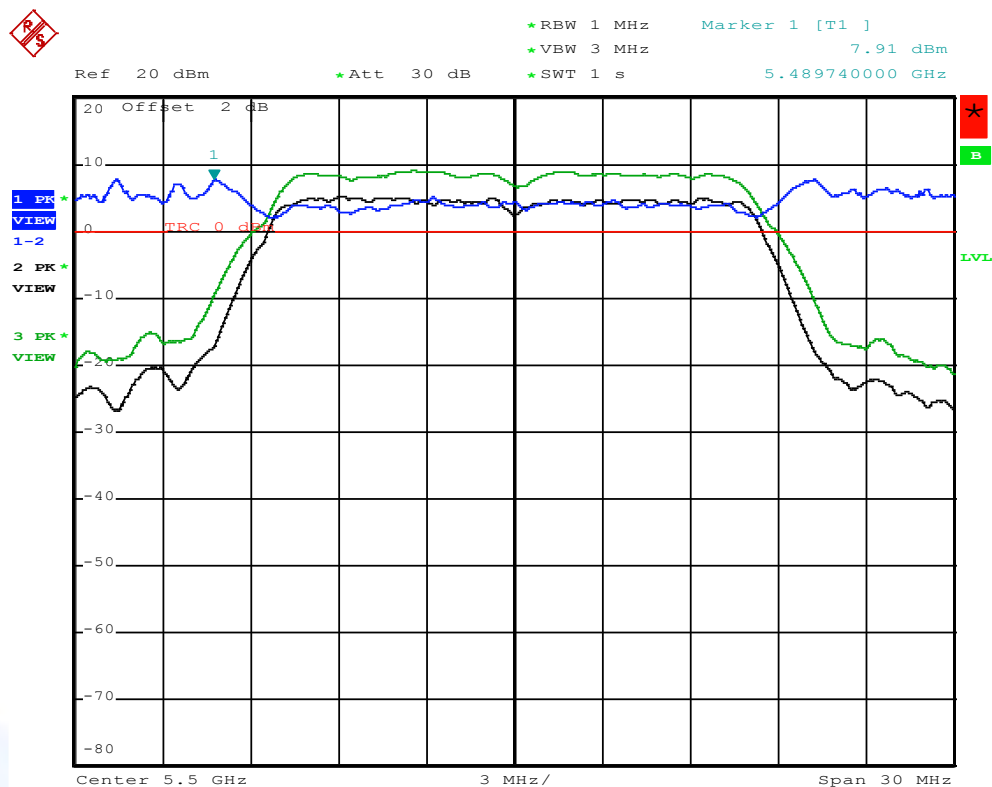
FCC:BV5SMALLENGINE Channel 56 (5280 MHz)



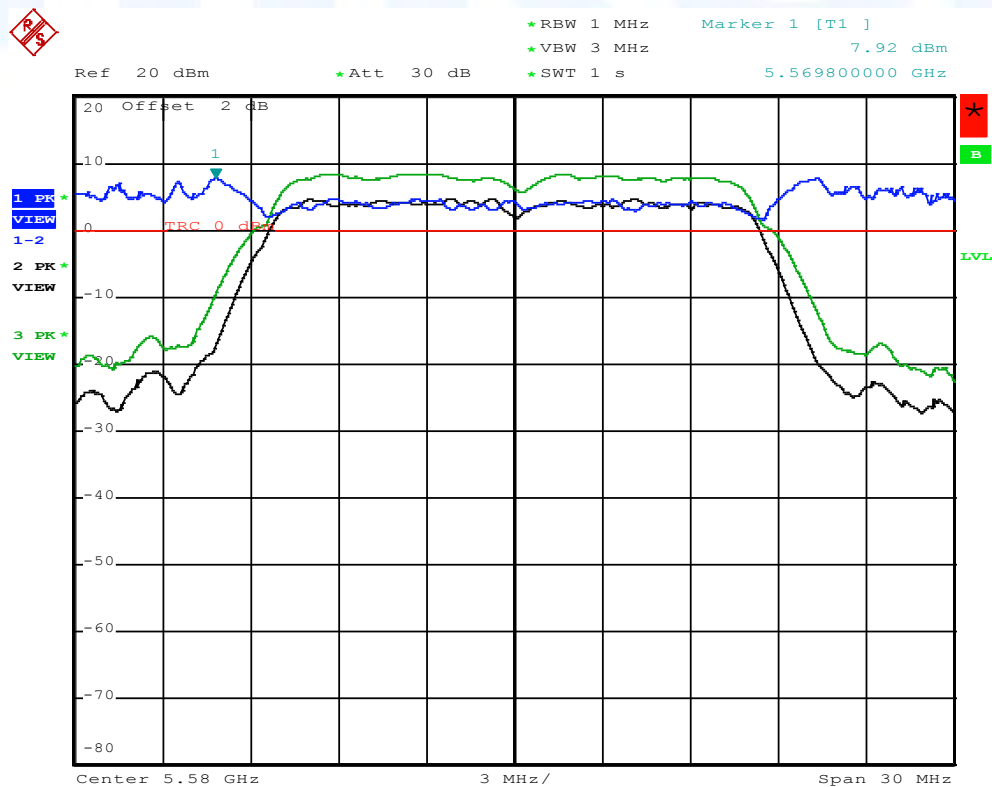
Channel 64 (5320 MHz)



FCC:BV5SMALLENGINE Channel 100 (5500 MHz)



Channel 116 (5580 MHz)



FCC:BV5SMALLENGINE

5.6 Undesirable emissions

For test instruments and accessories used see section 6 Part **SER 1**, **SER 2** and **SER 3**.

5.6.1 Description of the test location

Test location: Anechoic Chamber A2
Test location: OATS 1
Test distance: 3 metres

5.6.2 Photo documentation of the test set-up

Open area test site (Test setup for 9 kHz – 30 MHz)



Open area test site (Test setup for 30 MHz – 1000 MHz)



FCC:BV5SMALLENGINE

Anechoic chamber (Test setup for field strength measurement)



Anechoic chamber (Test setup for 18 GHz – 30 GHz)



FCC:BV5SMALLENGINE

Anechoic chamber (Test setup for 30 GHz – 40 GHz)



5.6.3 Applicable standard

According to FCC Part 15E, Section 15.407(b):

For transmitters operating in the defined bands shall not exceed the appropriate emission limit outside of the operating bands.

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a) (see Section 15.205(c)).

FCC:BV5SMALLENGINE

5.6.4 Description of Measurement

Radiated spurious emissions are measured with the setup set out in ANSI C63.4. If the emission level of the EUT in peak mode complies with the average limit then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported. Up from 8 GHz a HP filter is used. The measurement system for the frequency range 30 - 40 GHz converts the range down to 10 - 20 GHz. A conversion EIRP to Field strength is done with the formula $FS = \sqrt{(EIRP \cdot 30)/D}$; FS (V/m), EIRP (W), D (m).

Spectrum analyzer settings for peak values:

RBW: 1 MHz VBW: 1 MHz Sweep: Auto

Spectrum analyzer settings for average values:

RBW: 1 MHz VBW: 10 Hz Sweep: Auto

5.6.5 Test result

5.6.5.1 Radiated emissions outside of the operation frequency bands

Worst case condition for this measurement:

All radiated measurements are performed with the integrated Antenna 5 dBi and with the EUT settings:

Frequency offset = 27 for radiated sample;

HT20, Ant1 + Ant2:

Frequency band: 5.15 GHz to 5.25 GHz

CH36		CH40		CH48	
f (MHz)	Level (dBm)	f (MHz)	Level (dBm)	f (MHz)	Level (dBm)
-		-		-	
Measurement uncertainty			± 6 dB		

Frequency band: 5.25 GHz to 5.35 GHz

CH52		CH56		CH64	
f (MHz)	Level (dBm)	f (MHz)	Level (dBm)	f (MHz)	Level (dBm)
-		-		-	
Measurement uncertainty			± 6 dB		

Note: In frequency range 5.15-5.25 GHz technical requirements of operation applied.

Frequency band: 5.47 GHz to 5.725 GHz

CH100		CH128		CH140	
f (MHz)	Level (dBm)	f (MHz)	Level (dBm)	f (MHz)	Level (dBm)
-		-		-	
Measurement uncertainty			± 6 dB		

HT40, Ant1 + Ant2:

Frequency band: 5.15 GHz to 5.25 GHz

CH38			CH46		
f (MHz)	Level (dBm)	Limit (dBm)	f (MHz)	Level (dBm)	Limit (dBm)
-			-		
Measurement uncertainty			± 6 dB		

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Frequency band: 5.25 GHz to 5.35 GHz

CH54			CH62		
f (MHz)	Level (dBm)	Limit (dBm)	f (MHz)	Level (dBm)	Limit (dBm)
-			-		
Measurement uncertainty			± 6 dB		

Note: In frequency range 5.15-5.25 GHz technical requirements of operation applied.

Frequency band: 5.47 GHz to 5.725 GHz

CH102			CH134		
f (MHz)	Level (dBm)	Limit (dBm)	f (MHz)	Level (dBm)	Limit (dBm)
-			-		
Measurement uncertainty			± 6 dB		

802.11a, Ant1:

Frequency band: 5.15 GHz to 5.25 GHz

CH36		CH40		CH48	
f (MHz)	Level (dBm)	f (MHz)	Level (dBm)	f (MHz)	Level (dBm)
-		-		-	
Measurement uncertainty				± 6 dB	

Frequency band: 5.25 GHz to 5.35 GHz

CH52		CH56		CH64	
f (MHz)	Level (dBm)	f (MHz)	Level (dBm)	f (MHz)	Level (dBm)
-		-		-	
Measurement uncertainty				± 6 dB	

Note: In frequency range 5.15-5.25 GHz technical requirements of operation applied.

Frequency band: 5.47 GHz to 5.725 GHz

CH100		CH128		CH140	
f (MHz)	Level (dBm)	f (MHz)	Level (dBm)	f (MHz)	Level (dBm)
-		-		-	
Measurement uncertainty				± 6 dB	

Note: No emission could be detected within 20 dB to the limit in frequency range 9 kHz to 1000 MHz and 1 GHz to 40 GHz.

Limit according to FCC Part 15E, Section 15.407(b) for undesirable emissions:

Operating Frequency range (MHz)	Undesirable emission limit, EIRP (dBm/MHz)
5150 - 5250	-27.0
5250 - 5350	-27.0
5470 - 5725	-27.0

FCC:BV5SMALLENGINE

5.6.6 Radiated emissions and harmonics in restricted bands

HT20, Ant1 + Ant2:

Frequency band: 5.15 GHz to 5.25 GHz, restricted band from 4500 to 5150 MHz

Channel 36 (5180 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
-	Pk				-	-	74.0	
	AV				-	-	54.0	

Channel 48 (5240 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
5116	Pk				-	-	74.0	
	AV				-	-	54.0	

Frequency band: 5.25 GHz to 5.35 GHz, restricted band from 5350 to 5460 MHz

Channel 52 (5260 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
5250	Pk				-	-	74.0	
	AV				-	-	54.0	

Channel 64 (5320 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
5351	Pk				58.2	-	74.0	-15.8
	AV				40.3	-	54.0	-13.7
5372	Pk				54.5	-	74.0	-19.5
	AV				43.5	-	54.0	-9.5

Frequency band: 5.47 GHz to 5.725 GHz, restricted band from 5350 to 5460 MHz

Channel 100 (5500 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
5458	Pk				55.9	-	74.0	-18.1
	AV				34.3	-	54.0	-19.7
5442	Pk				54.7	-	74.0	-19.3
	AV				34.5	-	54.0	-19.5
5401	Pk				54.4	-	74.0	-19.6
	AV				33.1	-	54.0	-20.9

Channel 140 (5700 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
5381	Pk				55.3	52.1	74.0	-18.7
	AV				41.1	-	54.0	-12.9

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HT40, Ant1 + Ant2:

Frequency band: 5.15 GHz to 5.25 GHz, restricted band from 4500 to 5150 MHz

Channel 38 (5190 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
5150	Pk				57.2	61.2	74.0	-12.8
	AV				42.6	43.9	54.0	-10.1

Channel 46 (5230 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
-	Pk				-	-	74.0	
	AV				-	-	54.0	

Frequency band: 5.25 GHz to 5.35 GHz, restricted band from 5350 to 5460 MHz

Channel 54 (5270 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
5377	Pk				54.5	-	74.0	-19.5
	AV				40.1	-	54.0	-13.9
5434	Pk				54.4	52.2	74.0	-19.6
	AV				40.6	-	54.0	-13.4

Channel 62 (5310 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
5351	Pk				60.3	56.5	74.0	-13.7
	AV				44.1	-	54.0	-9.9

Frequency band: 5.47 GHz to 5.725 GHz, restricted band from 5350 to 5460 MHz

Channel 102 (5510 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
5357	Pk				54.8	-	74.0	-19.2
	AV				40.8	-	54.0	-13.2
5457	Pk				59.9	-	74.0	-14.1
	AV				43.5	-	54.0	-10.5

Channel 134 (5670 MHz), restricted band from 5350 to 5460 MHz

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
	Pk				-	-	74.0	
	AV				-	-	54.0	

FCC:BV5SMALLENGINE

Channel 134 (5670 MHz), restricted band from 4500 to 5150 MHz

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
4536	Pk				48.8	50.7	74.0	-23.3
	AV				-	-	54.0	

Note: Only emission detected within 20 dB to the peak limit are recorded.

802.11a, Ant1:

Frequency band: 5.15 GHz to 5.25 GHz, restricted band from 4500 to 5150 MHz

Channel 36 (5180 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
-	Pk				-	-	74.0	
	AV				-	-	54.0	

Channel 48 (5240 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
-	Pk				-	-	74.0	
	AV				-	-	54.0	

Frequency band: 5.25 GHz to 5.35 GHz, restricted band from 5350 to 5460 MHz

Channel 52 (5260 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
-	Pk				-	-	74.0	
	AV				-	-	54.0	

Channel 64 (5320 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor	vert		hor	vert		
		dB(μV/m)	dB(μV/m)		dB(μV/m)	dB(μV/m)		
-	Pk				-	-	74.0	
	AV				-	-	54.0	

Frequency band: 5.47 GHz to 5.725 GHz, restricted band from 5350 to 5460 MHz

Channel 100 (5500 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
-	Pk				-	-	74.0	
	AV				-	-	54.0	

Frequency band: 5.47 GHz to 5.725 GHz, restricted band from 3600 to 4400 MHz

Channel 100 (5500 MHz)

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
4399	Pk						74.0	
	AV				-	-	54.0	

FCC:BV5SMALLENGINE

Channel 140 (5700 MHz) restricted band from 5350 to 5460 MHz

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
-	Pk				-	-	74.0	
	AV				-	-	54.0	

Channel 140 (5700 MHz) restricted band from 4500 to 5150 MHz

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit dB(μV/m)	Delta (dB)
		hor dB(μV/m)	vert dB(μV/m)		hor dB(μV/m)	vert dB(μV/m)		
-	Pk						74.0	
	AV				-	-	54.0	

Radiated limits according to FCC Part 15C, Section 15.209(a):

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(μV/m)	dB(μV/m)	
0.009 - 0.490	2400/F(kHz)		300
0.490 - 1.705	24000/F(kHz)		30
1.705 - 30	30	29,5	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

FCC Part 15C, Section 15.205, restricted bands of operation:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	Above 38.6

The requirements are **FULFILLED**.

Remarks: The measurement was performed from 9 kHz up to 40 GHz. For detailed test results please see the following test protocols. Only the worst case of the plots is listed.

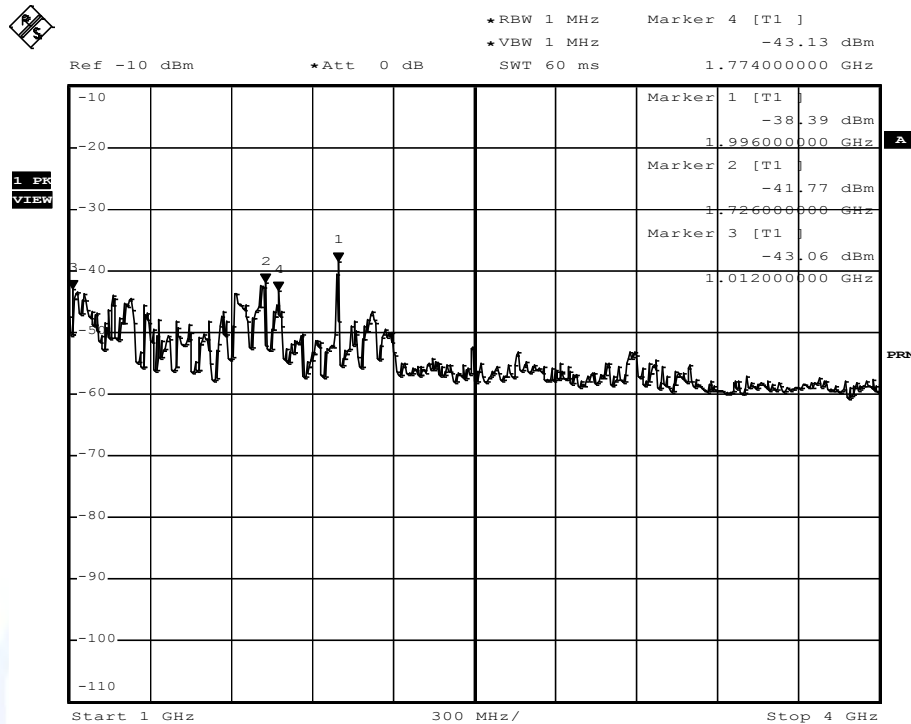
FCC:BV5SMALLENGINE

5.6.7 Undesirable emission plots

HT20: Frequency band from 5.15 GHz to 5.25 GHz

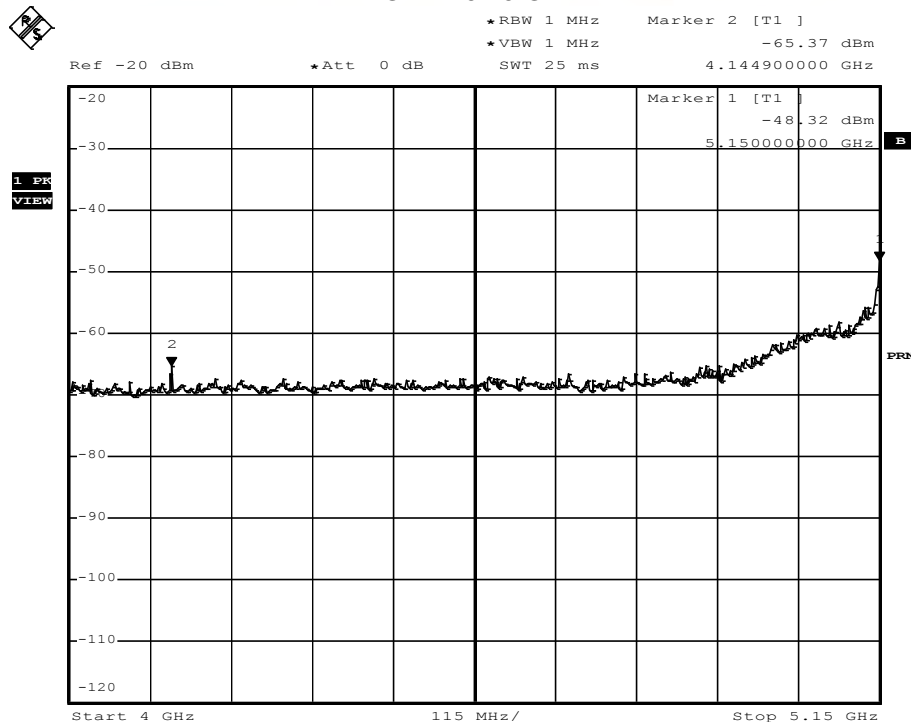
Channel 36 (5180 MHz)

EUT settings: TXPOW0=3, TXPOW1=5, TXANT=0, TXMODE=3, TXMCS=0, TXBW=0, ATE=TXCONT;
1 GHz – 4 GHz



Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;
1012 MHz, -43.1 dBm → 41.0 dBμV/m;

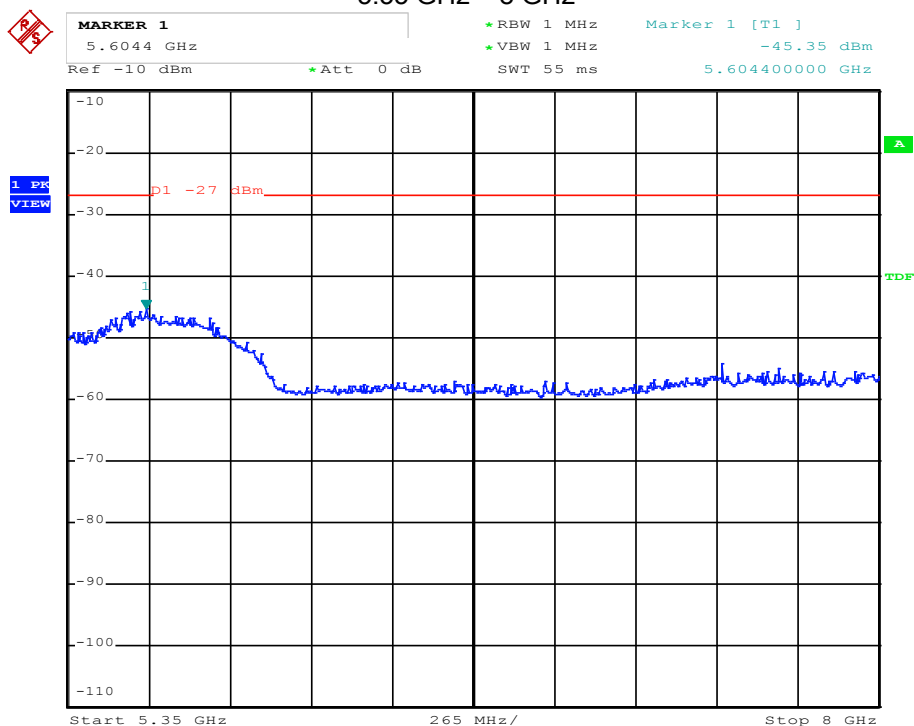
4 GHz – 5.15 GHz



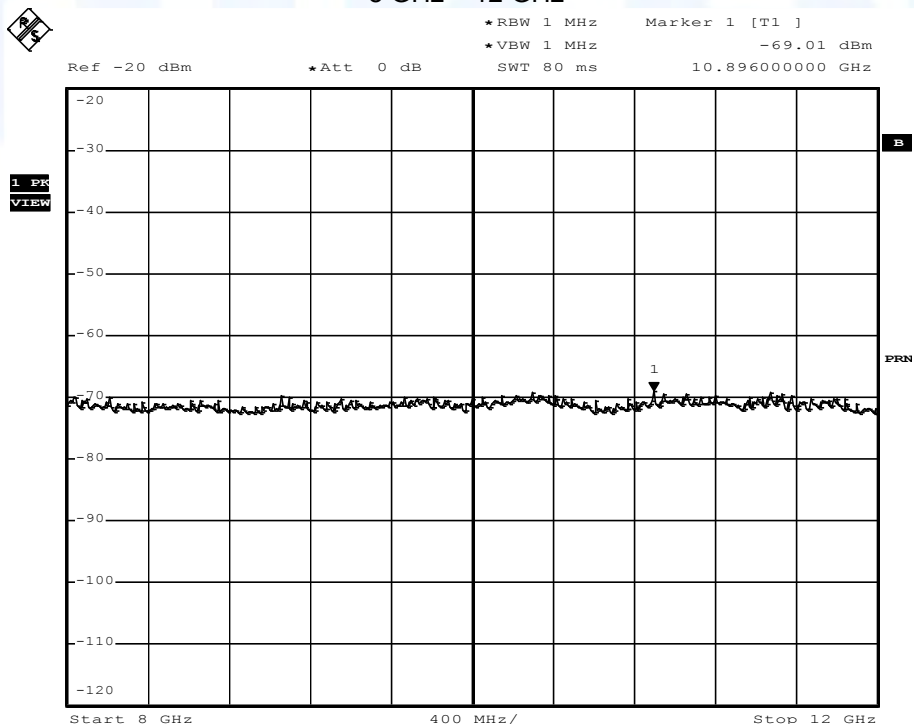
Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;
4144 MHz, -65.4 dBm → 39.2 dBμV/m;

FCC:BV5SMALLENGINE

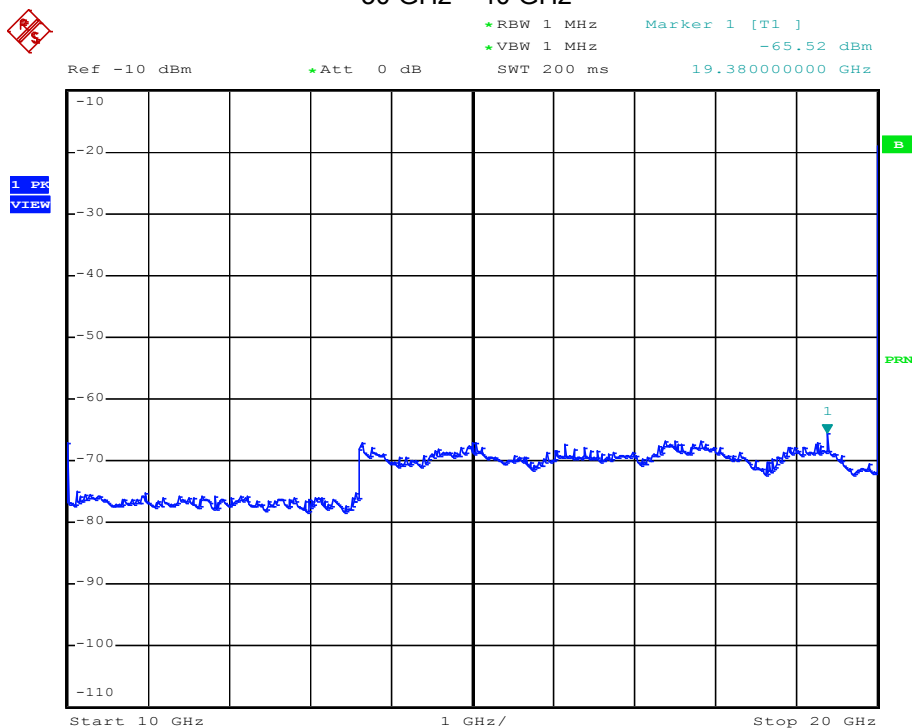
5.35 GHz – 8 GHz



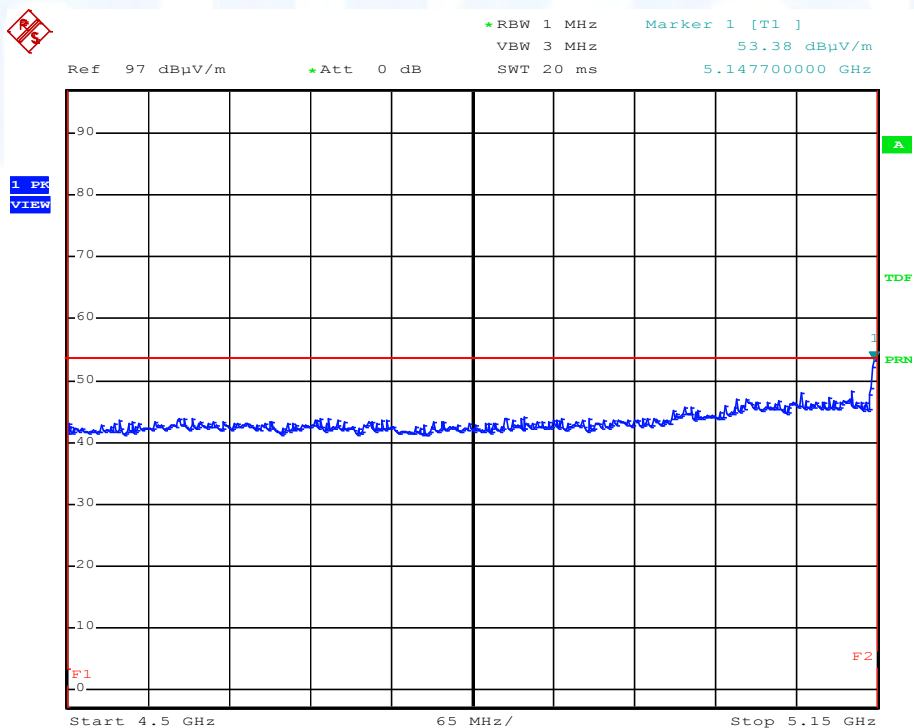
8 GHz – 12 GHz



FCC:BV5SMALLENGINE 30 GHz – 40 GHz



Peak plot in restricted band from 4500 to 5150 MHz



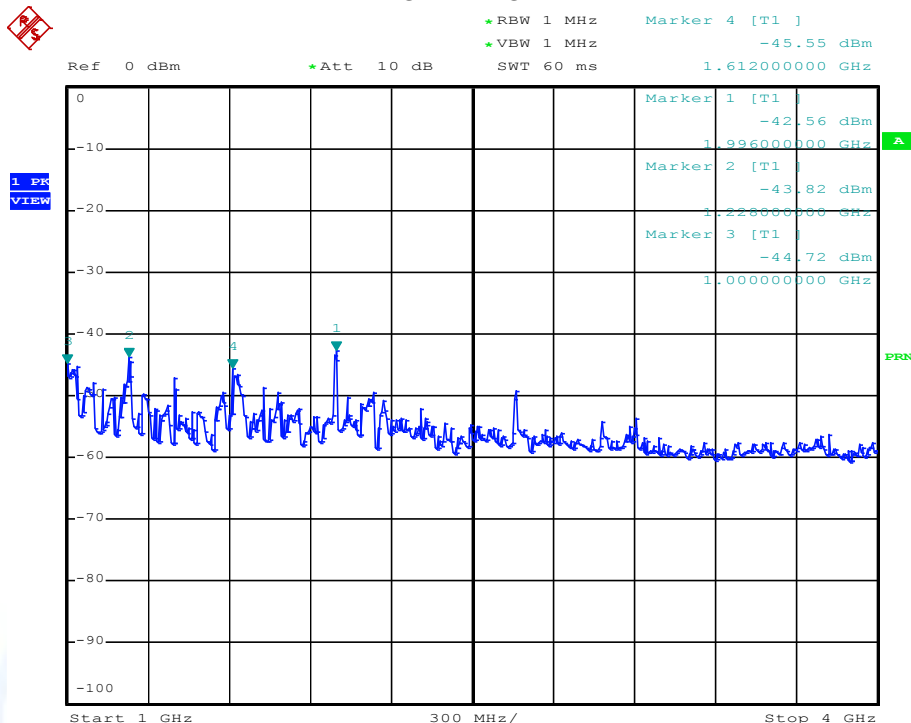
FCC:BV5SMALLENGINE

Frequency band from 5.15 GHz to 5.25 GHz:

Channel 48 (5240 MHz)

EUT settings: TXPOW0=2, TXPOW1=3, TXANT=0, TXMODE=3, TXMCS=0, TXBW=0, ATE=TXCONT

1 GHz – 4 GHz

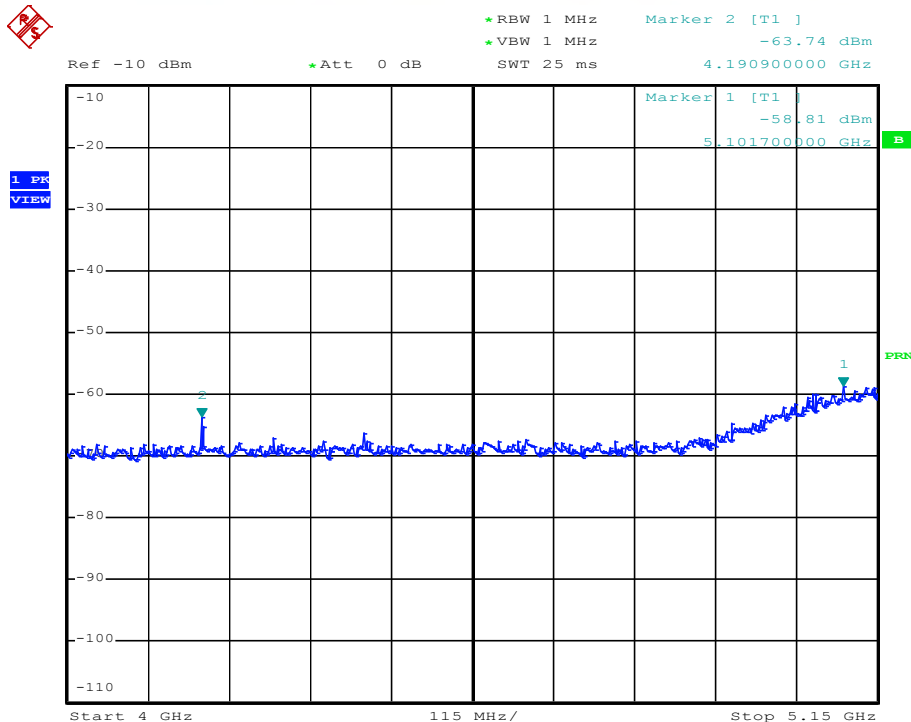


Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;

1228 MHz, -43.8 dBm → 41.2 dBμV/m;

1612 MHz, -45.5 dBm → 40.3 dBμV/m;

4 GHz – 5.15 GHz



4190 MHz, -63.7 dBm → 40.3 dBμV/m;

FCC:BV5SMALLENGINE

5.35 GHz – 8 GHz



MARKER 1
5.774 GHz

*RBW 1 MHz

Marker 1 [T1]

*VBW 1 MHz

-48.62 dBm

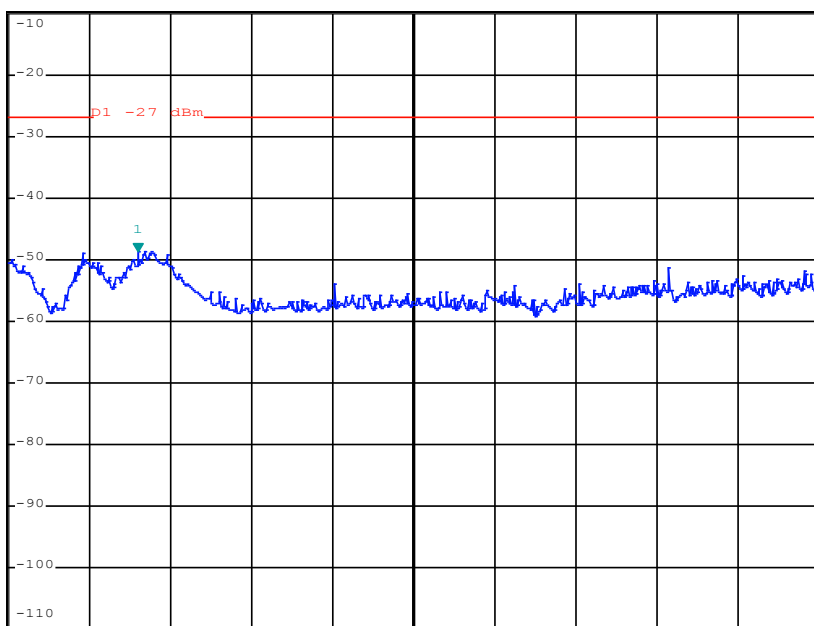
Ref -10 dBm

*Att 0 dB

SWT 55 ms

5.774000000 GHz

1 PK
VIEW



Start 5.35 GHz

265 MHz/

Stop 8 GHz

8 GHz – 12 GHz



Ref -10 dBm

*Att 0 dB

*RBW 1 MHz

Marker 1 [T1]

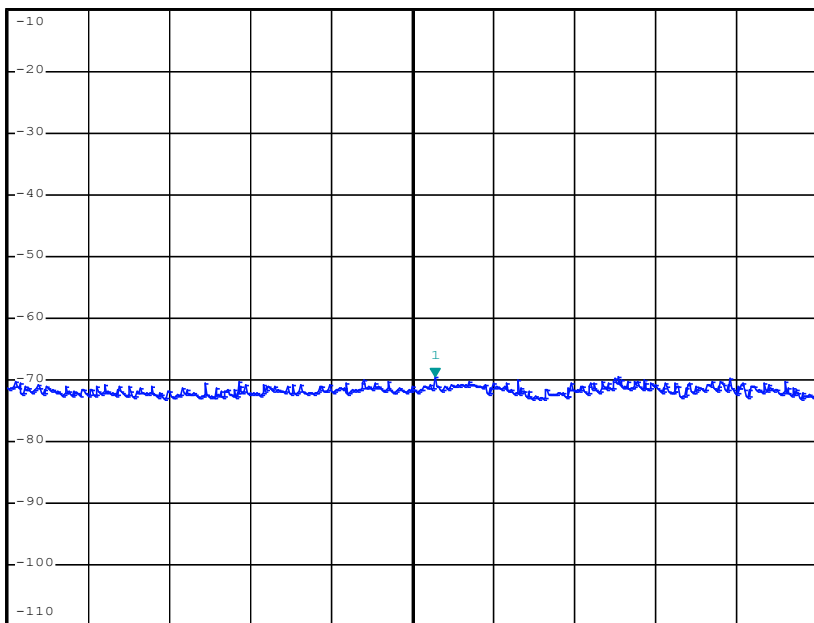
*VBW 1 MHz

-69.37 dBm

SWT 80 ms

10.112000000 GHz

1 PK
VIEW



Start 8 GHz

400 MHz/

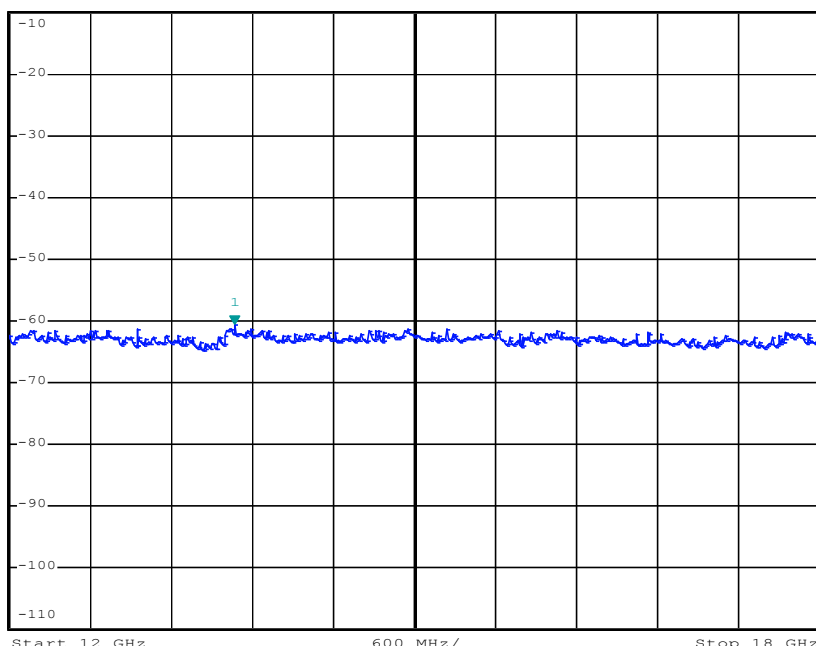
Stop 12 GHz

FCC:BV5SMALLENGINE 12 GHz - 18 GHz



1 PK
VIEW

Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -60.53 dBm
SWT 120 ms 13.668000000 GHz

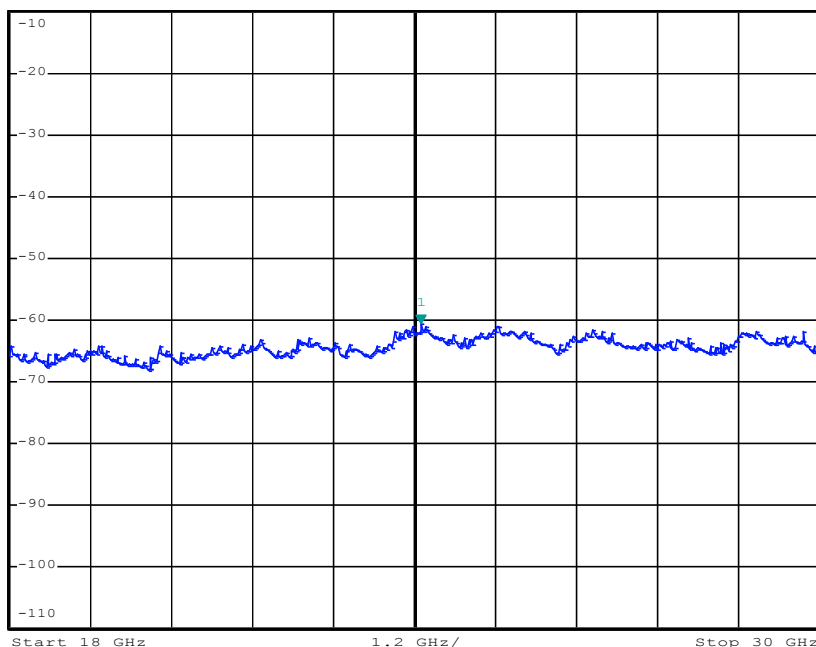


18 GHz - 30 GHz

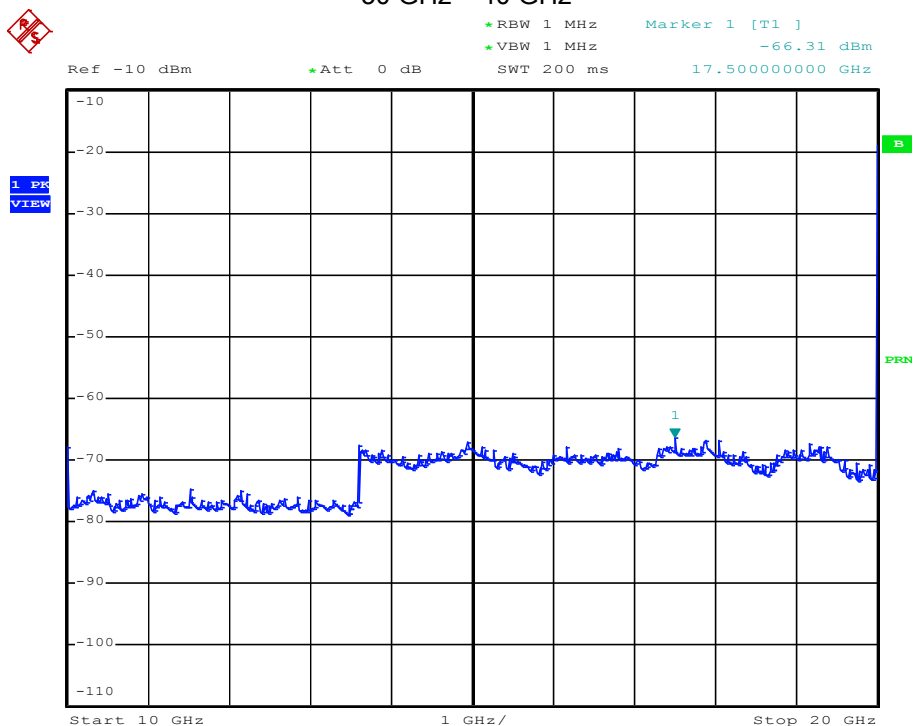


1 PK
VIEW

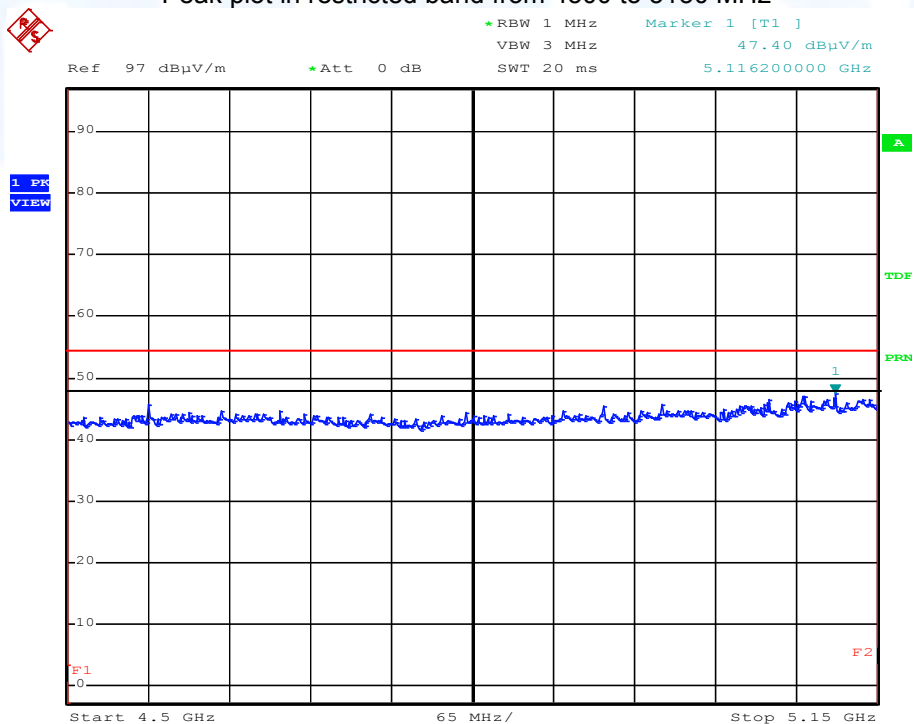
Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -60.59 dBm
SWT 240 ms 24.096000000 GHz



FCC:BV5SMALLENGINE 30 GHz – 40 GHz



Peak plot in restricted band from 4500 to 5150 MHz

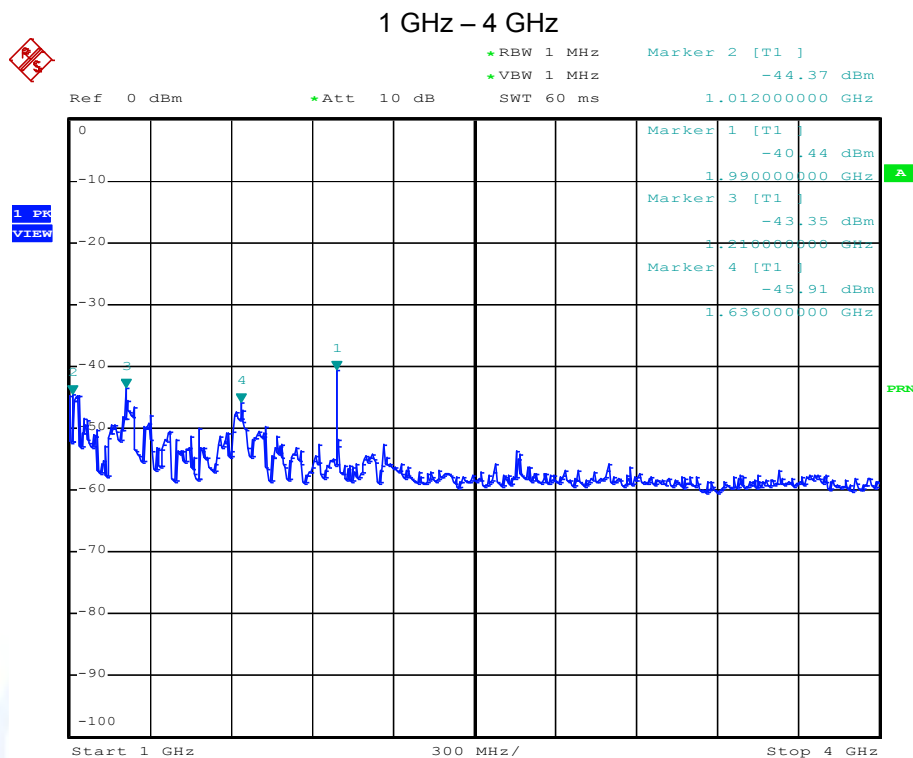


FCC:BV5SMALLENGINE

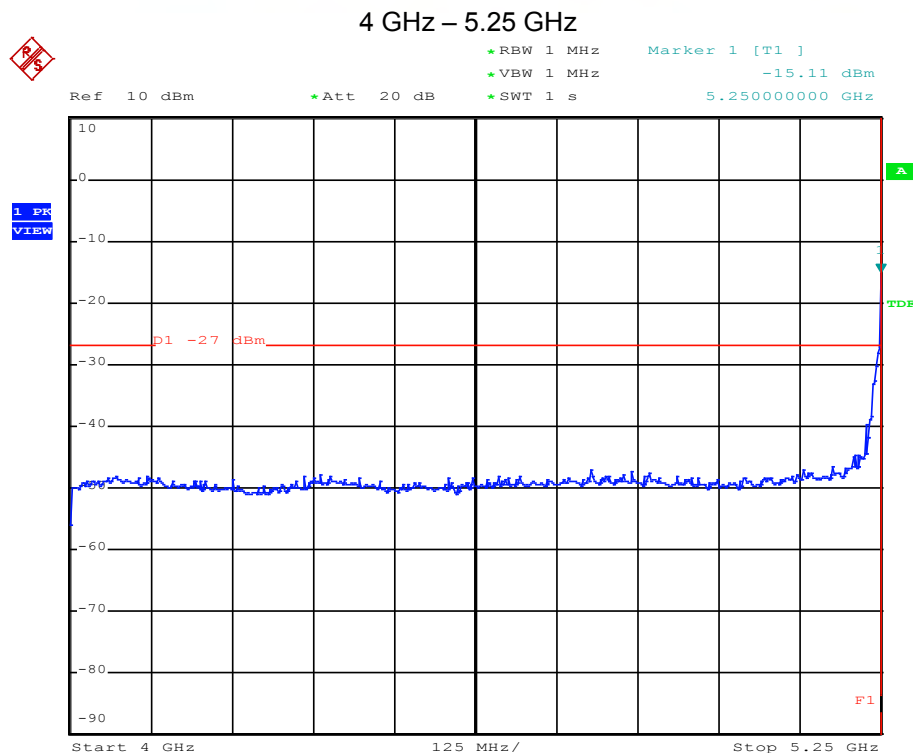
Frequency band from 5.25 GHz to 5.35 GHz:

Channel 52 (5260 MHz)

EUT settings: TXPOW0=1, TXPOW1=2, TXANT=0, TXMODE=3, TXMCS=0, TXBW=0, ATE=TXCONT

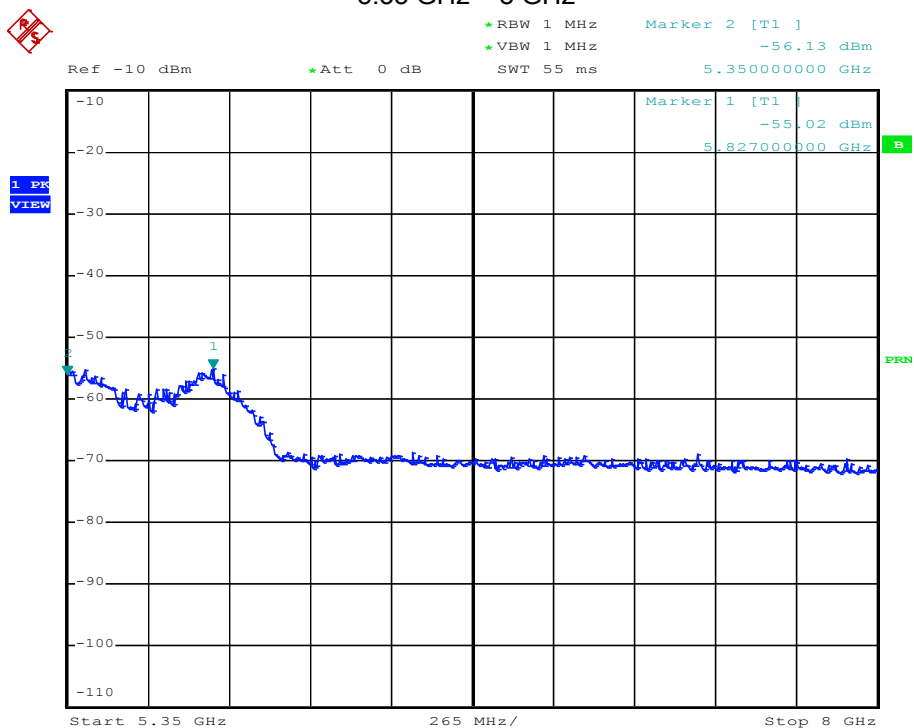


Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;
1216 MHz, -44 dBm → 40.8 dBμV/m;

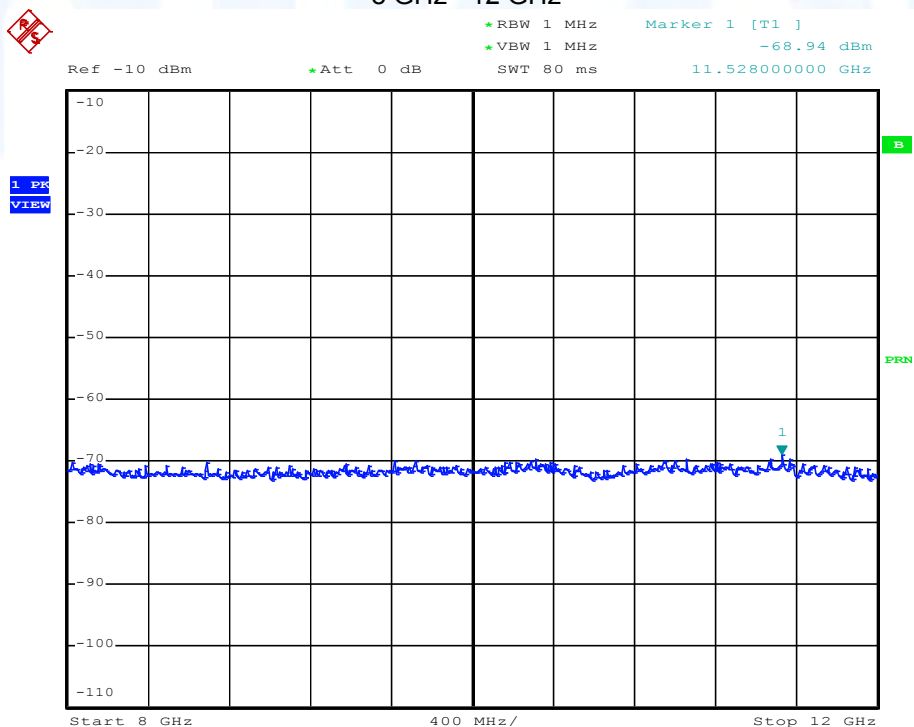


FCC:BV5SMALLENGINE

5.35 GHz – 8 GHz



8 GHz - 12 GHz

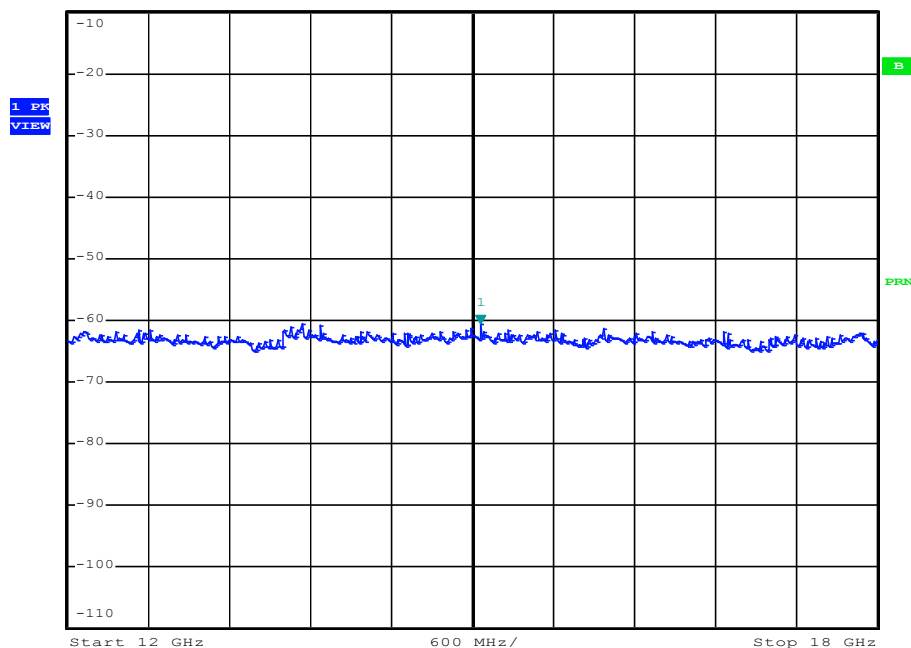


FCC:BV5SMALLENGINE

12 GHz – 18 GHz



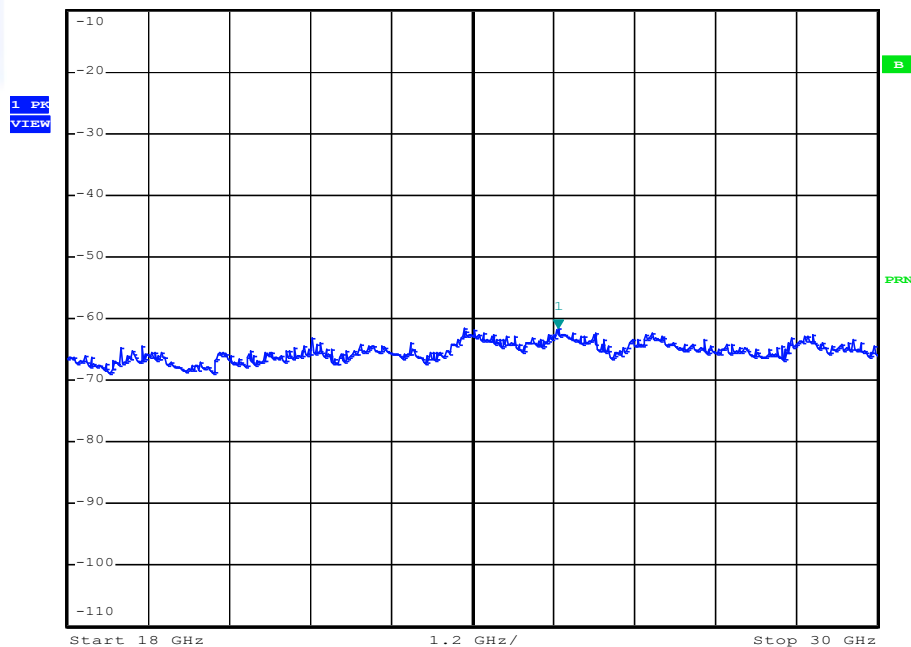
Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -60.57 dBm
SWT 120 ms 15.060000000 GHz



18 GHz – 30 GHz

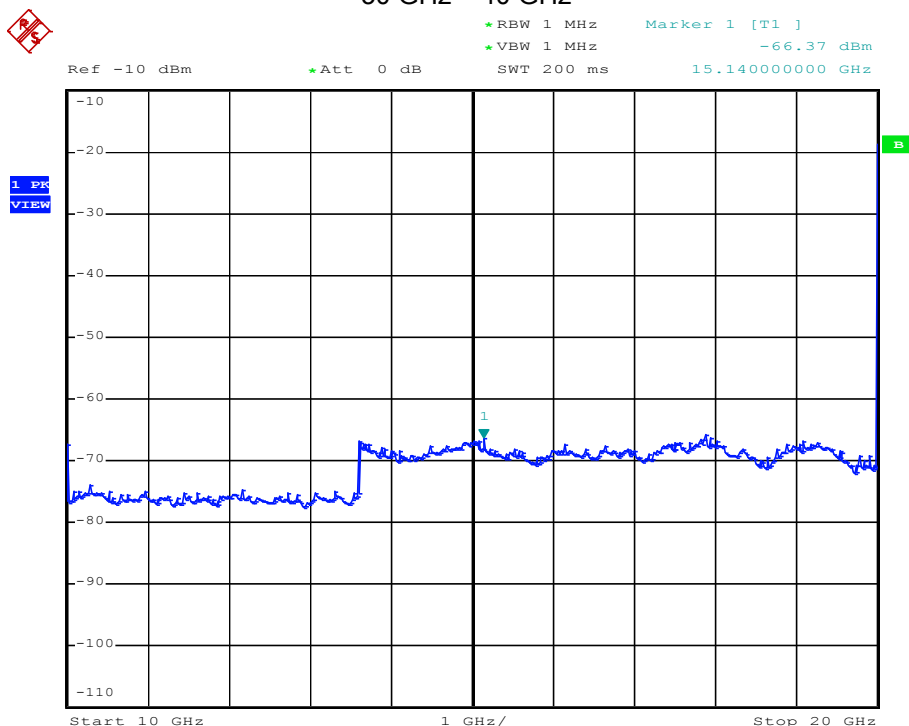


Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -61.52 dBm
SWT 240 ms 25.272000000 GHz



FCC:BV5SMALLENGINE

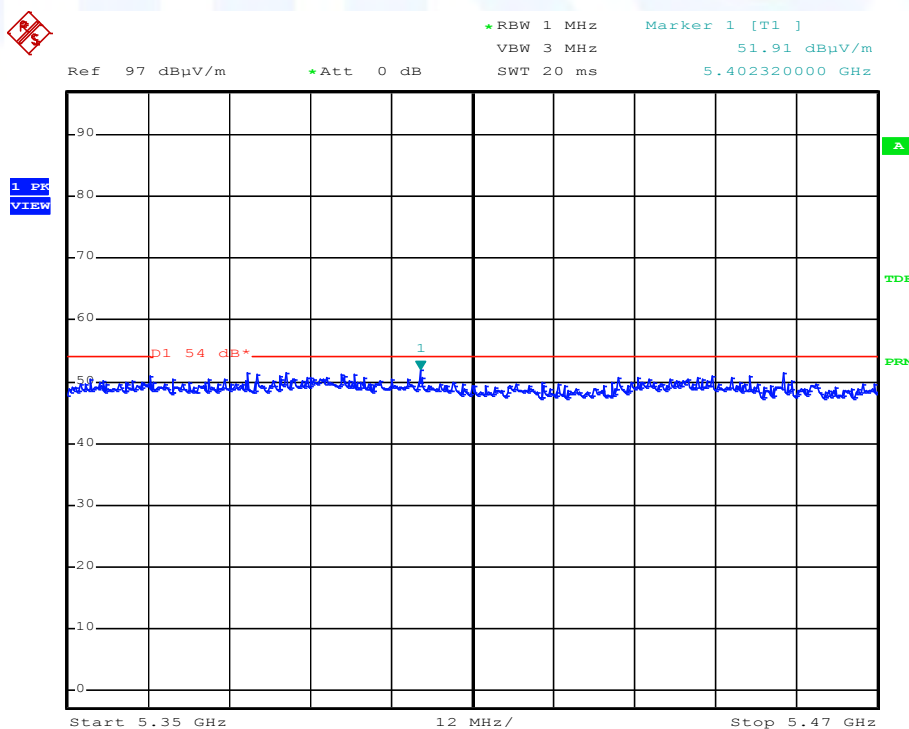
30 GHz – 40 GHz



At 10 and 20 GHz are the oscillator frequencies of the mixer and no spurious emissions.

Restricted band emission levels at the upper band edge.

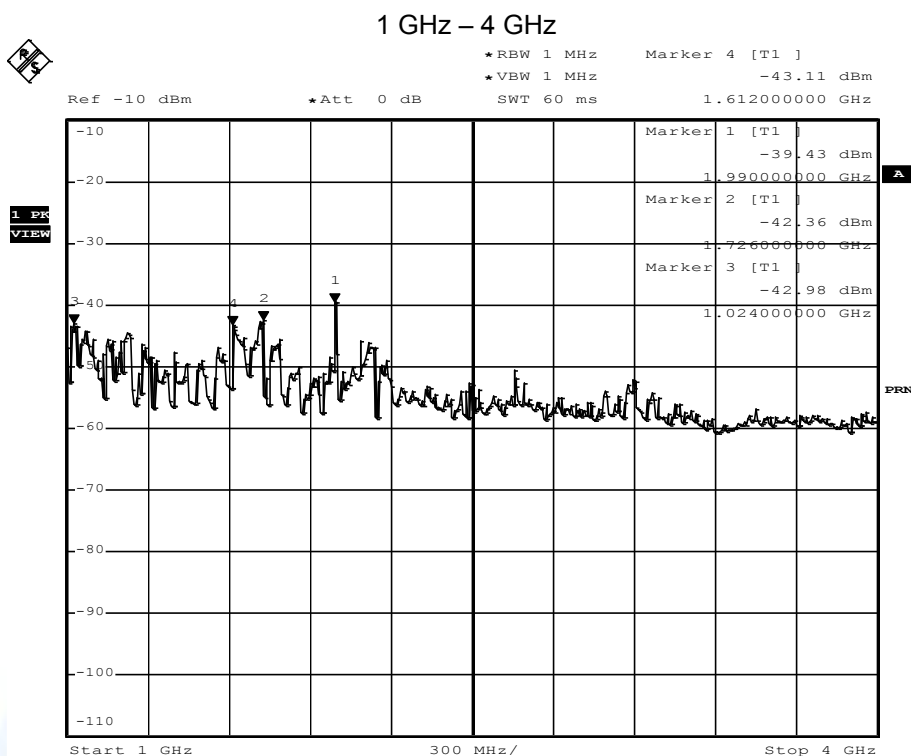
Peak plot in restricted band from 5350 to 5460 MHz



FCC:BV5SMALLENGINE

Channel 64 (5320 MHz)

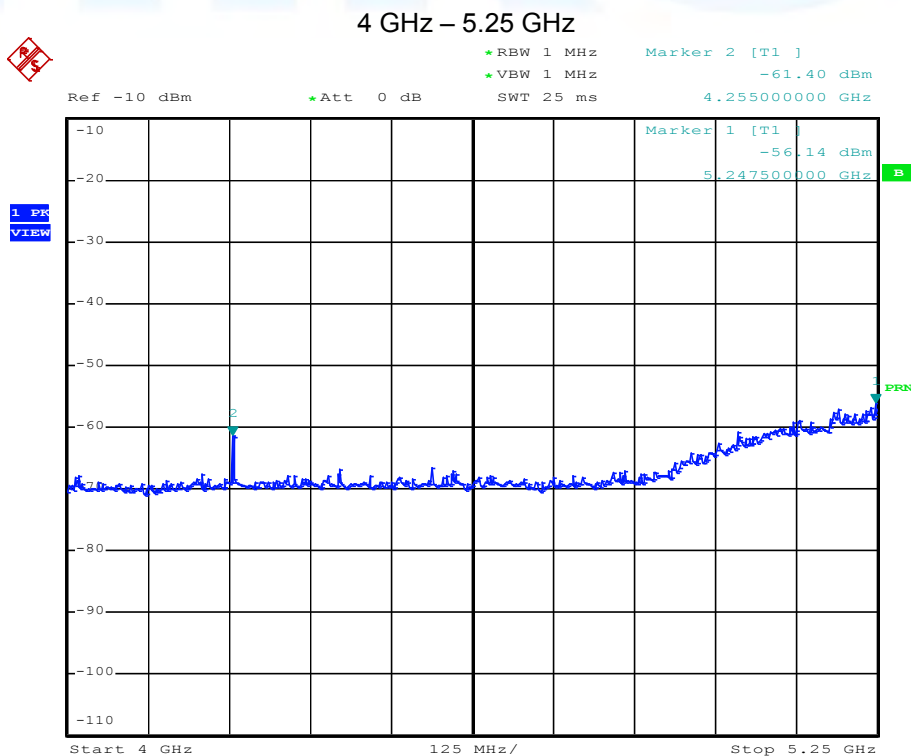
EUT settings: TXPOW0=1, TXPOW0=0, TXANT=0, TXMODE=3, TXMCS=0, TXBW=0, ATE=TXCONT



Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;

1024 MHz, -43.0 dBm → 41.2 dBμV/m;

1612 MHz, -43.1 dBm → 42.7 dBμV/m;



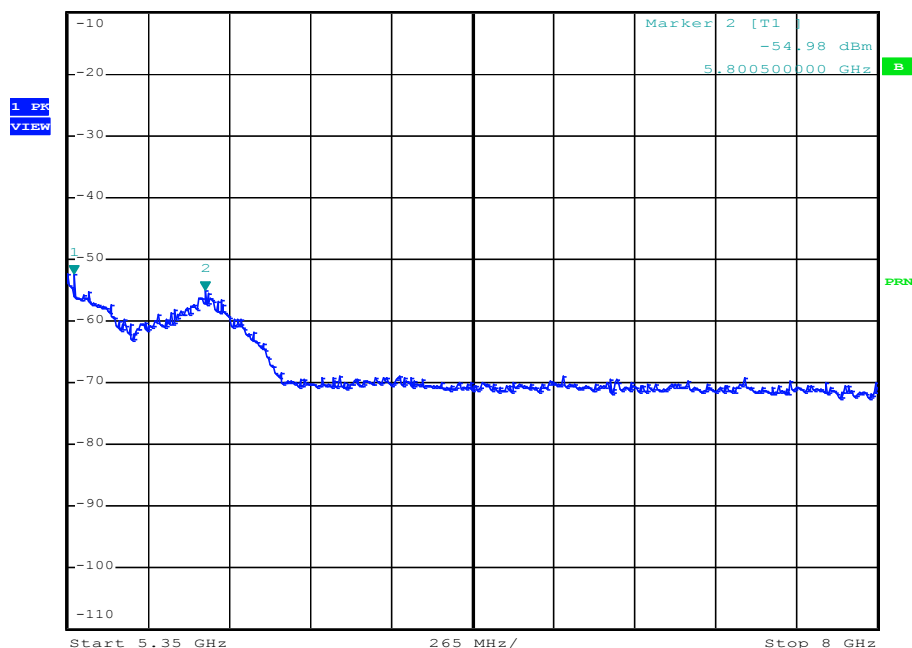
4255 MHz, -61.4 dBm → 42.4 dBμV/m;

FCC:BV5SMALENGINE

5.35 GHz – 8 GHz



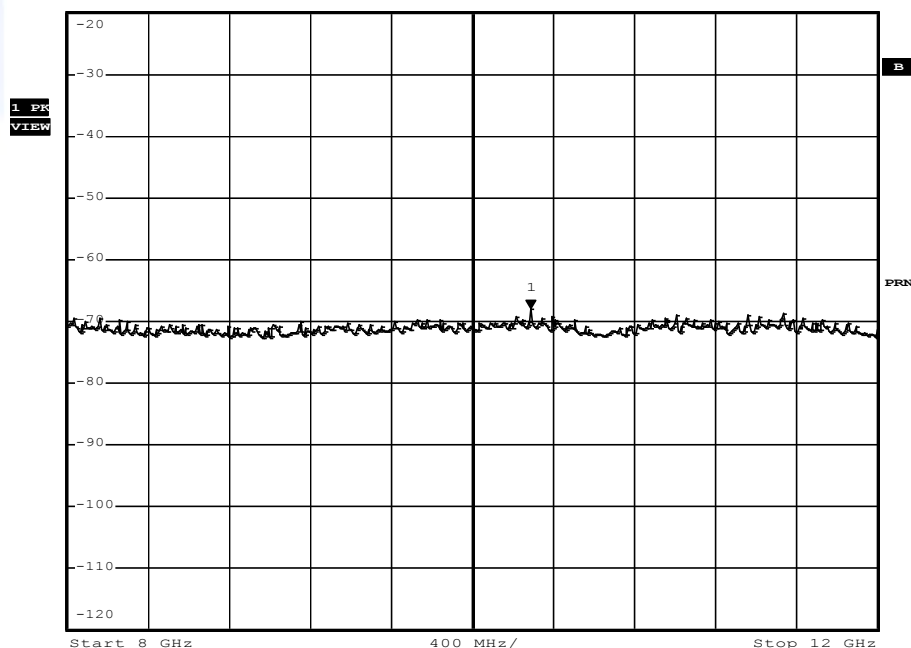
Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1] -52.34 dBm
*VBW 1 MHz 5.371200000 GHz
SWT 55 ms



8 GHz – 12 GHz



Ref -20 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1] -68.00 dBm
*VBW 1 MHz 10.288000000 GHz
SWT 80 ms

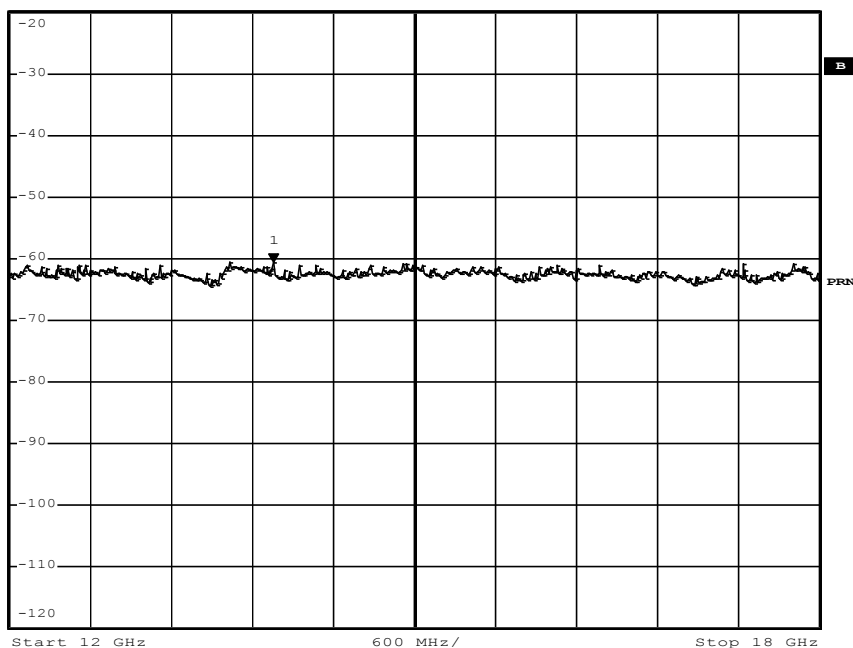


FCC:BV5SMALLENGINE 12 GHz - 18 GHz



1 PK
VIEW

Ref -20 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -60.47 dBm
SWT 120 ms 13.956000000 GHz

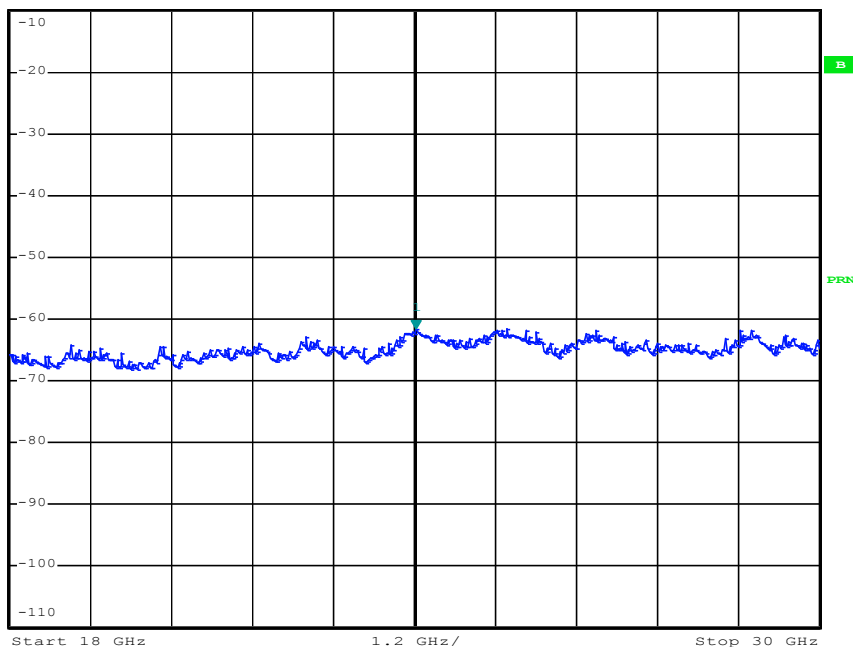


18 GHz – 30 GHz

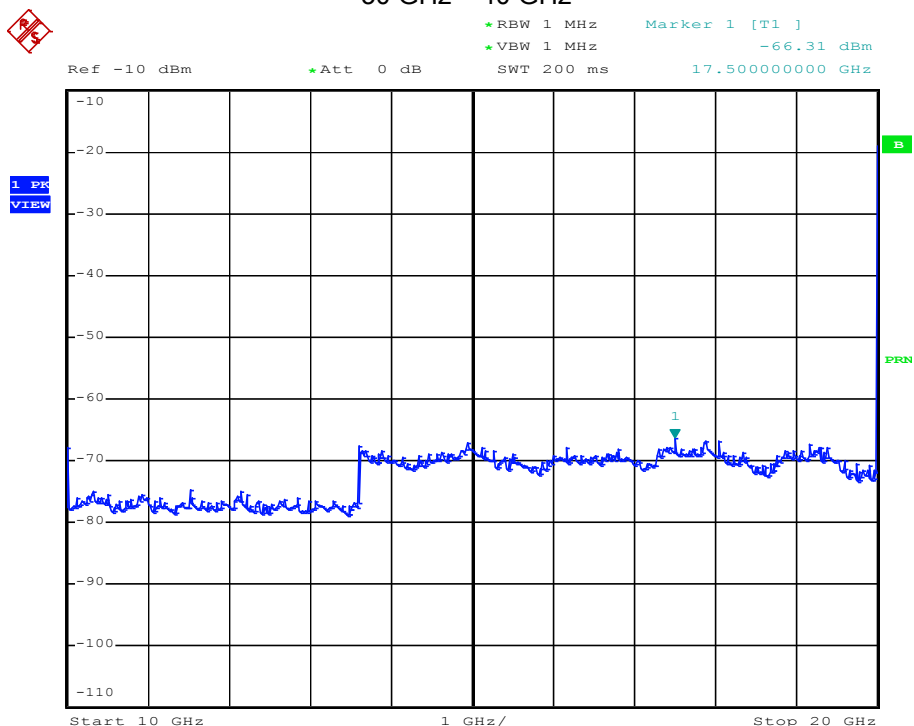


1 PK
VIEW

Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -61.56 dBm
SWT 240 ms 24.024000000 GHz

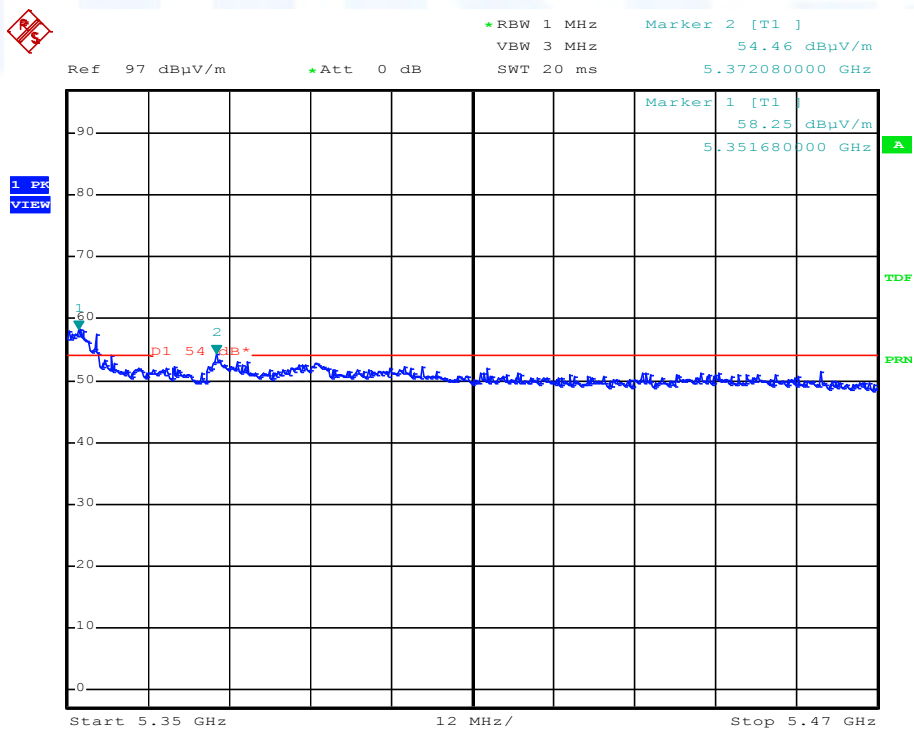


FCC:BV5SMALLENGINE 30 GHz – 40 GHz

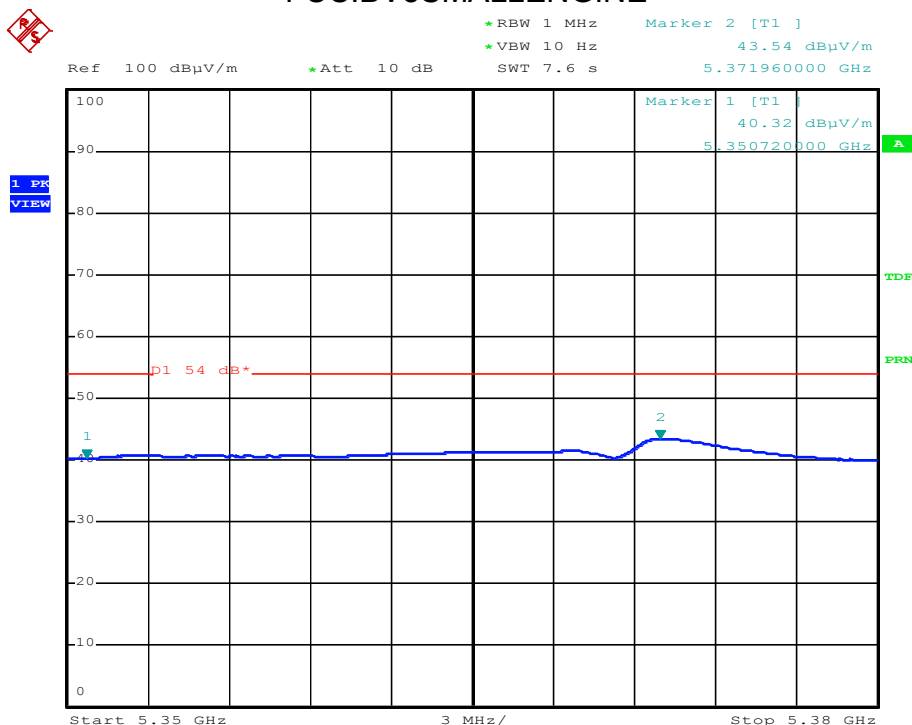


Restricted band emission levels at the upper band edge.

Peak and AV plot in restricted band from 5350 to 5460 MHz



FCC:BV5SMALLENGINE

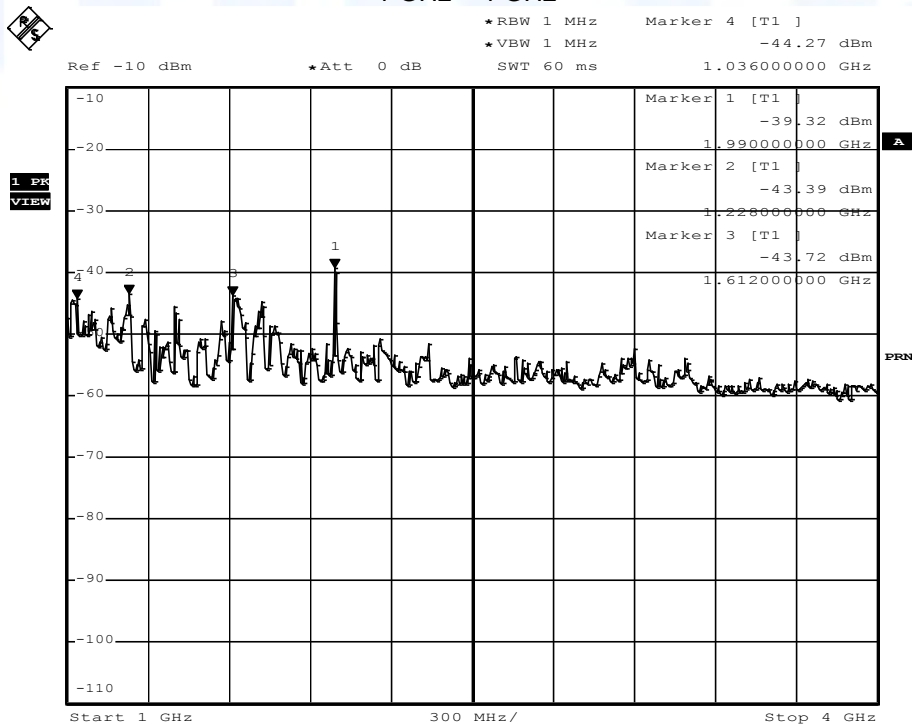


Frequency band from 5.47 GHz to 5.725 GHz:

Channel 100 (5500 MHz)

EUT settings: TXPOW0=0, TXPOW1=0, TXANT=0, TXMODE=3, TXMCS=0, TXBW=0, ATE=TXCONT

1 GHz – 4 GHz



Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;

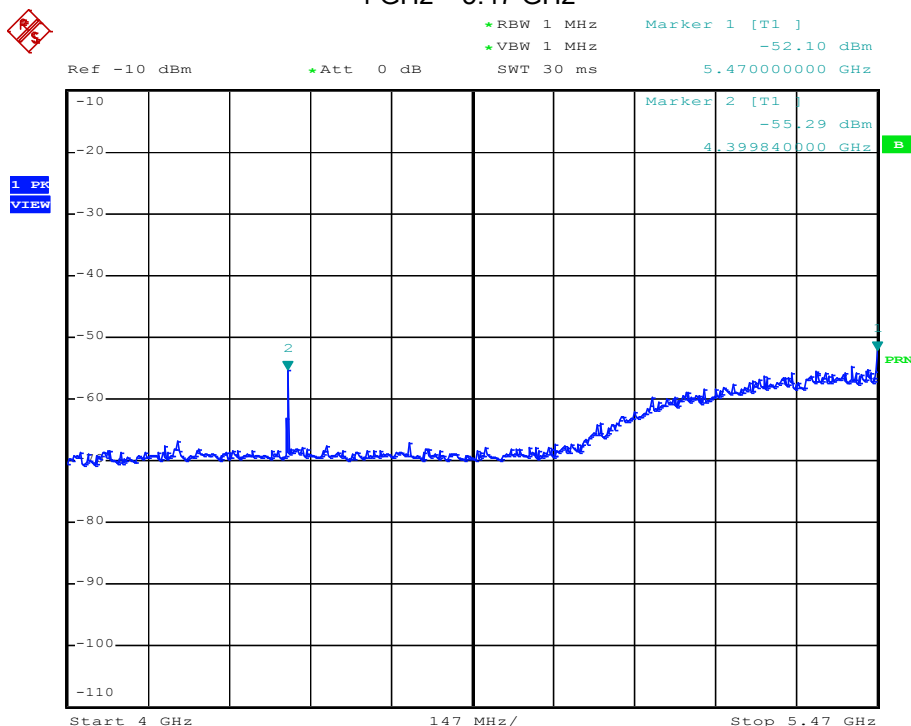
1036 MHz, -44.3 dBm → 40.0 dBμV/m;

1228 MHz, -43.4 dBm → 41.6 dBμV/m;

1612 MHz, -43.7 dBm → 39.6 dBμV/m;

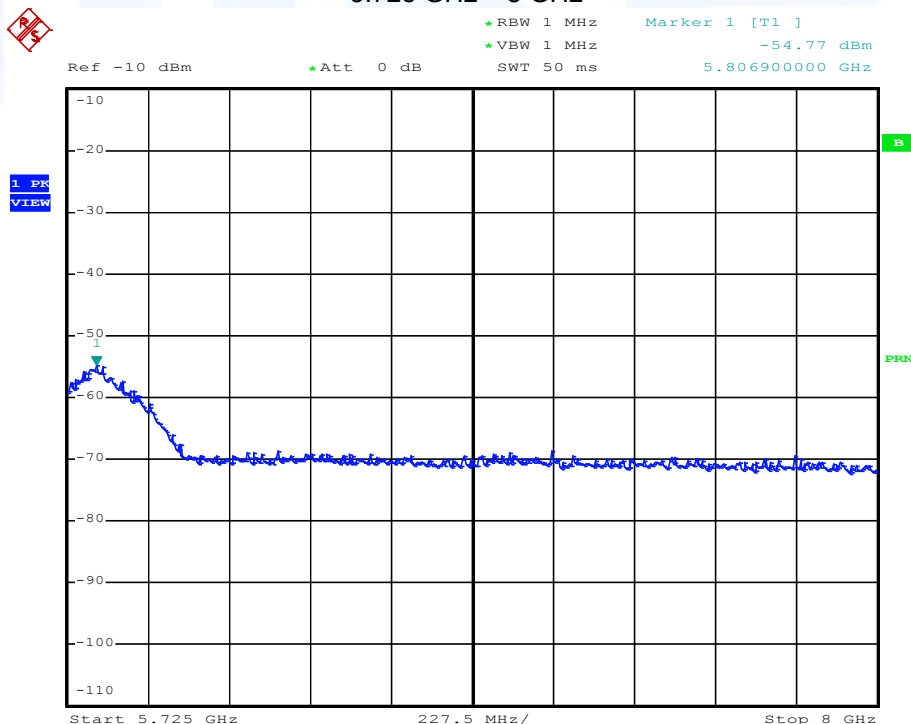
FCC:BV5SMALLENGINE

4 GHz – 5.47 GHz



Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;
4399 MHz, -55.3 dBm → 49.4 dBμV/m;

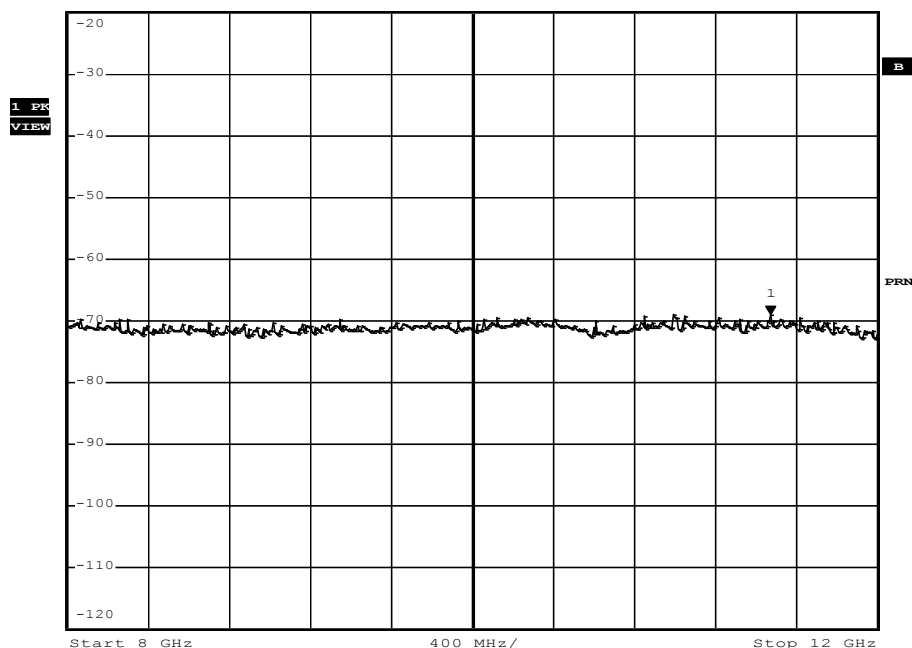
5.725 GHz – 8 GHz



FCC:BV5SMALLENGINE 8 GHz – 12 GHz



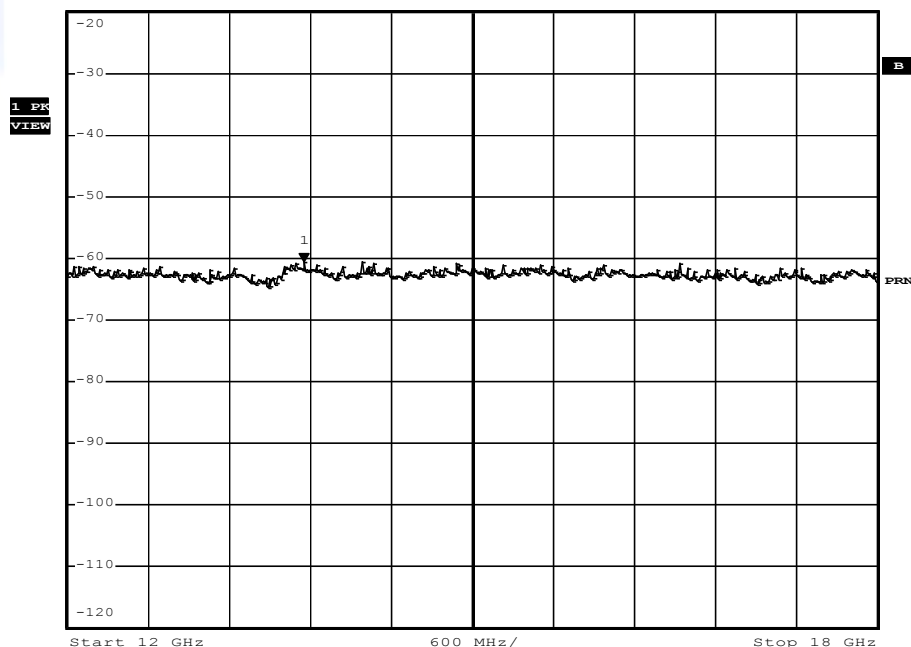
Ref -20 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1] -68.87 dBm
*VBW 1 MHz SWT 80 ms 11.472000000 GHz



12 GHz - 18 GHz



Ref -20 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1] -60.44 dBm
*VBW 1 MHz SWT 120 ms 13.752000000 GHz

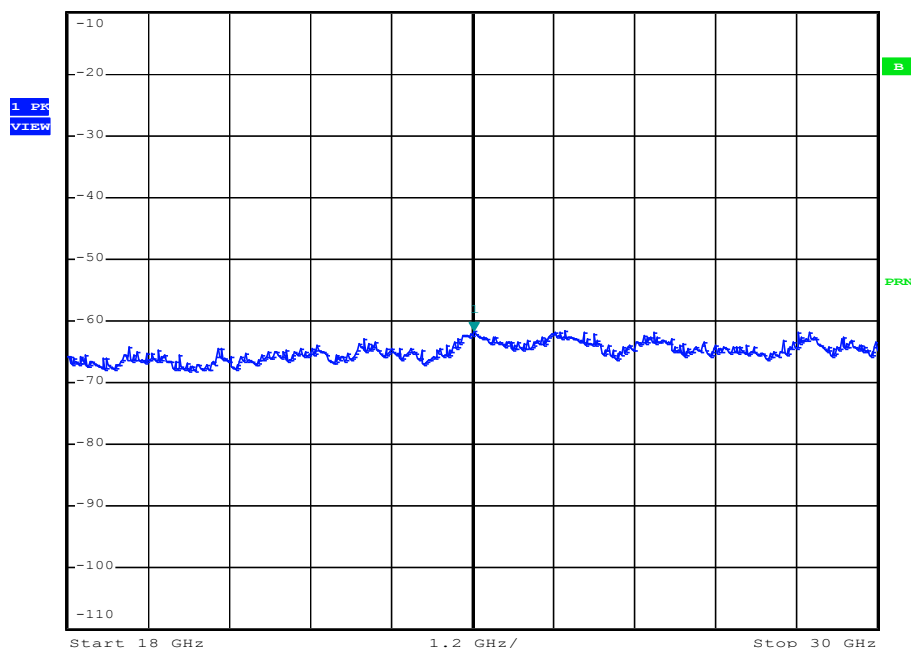


FCC:BV5SMALLENGINE

18 GHz – 30 GHz



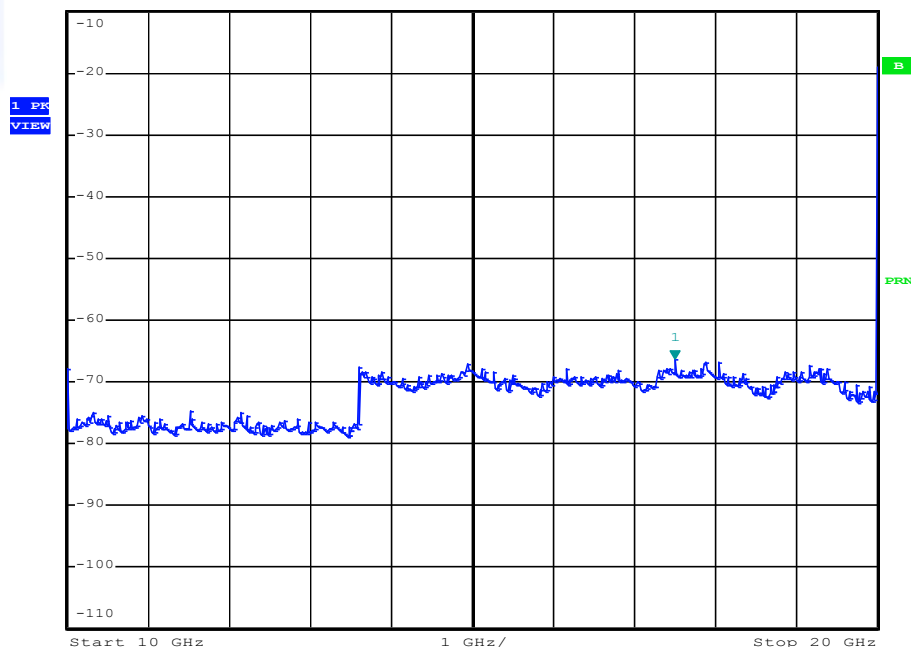
Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1] -61.56 dBm
*VBW 1 MHz SWT 240 ms 24.024000000 GHz



30 GHz – 40 GHz

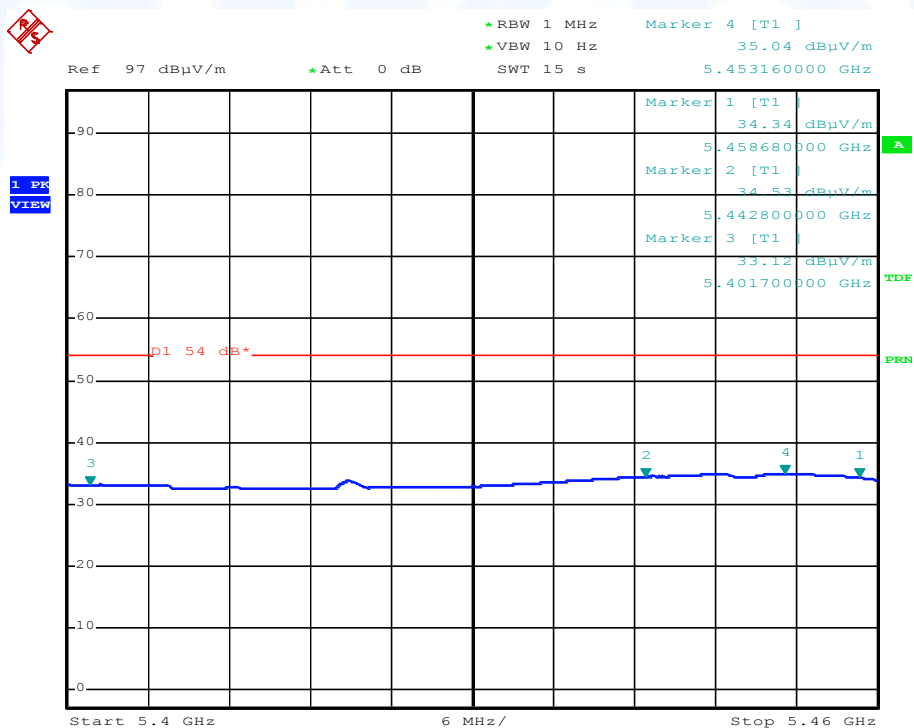
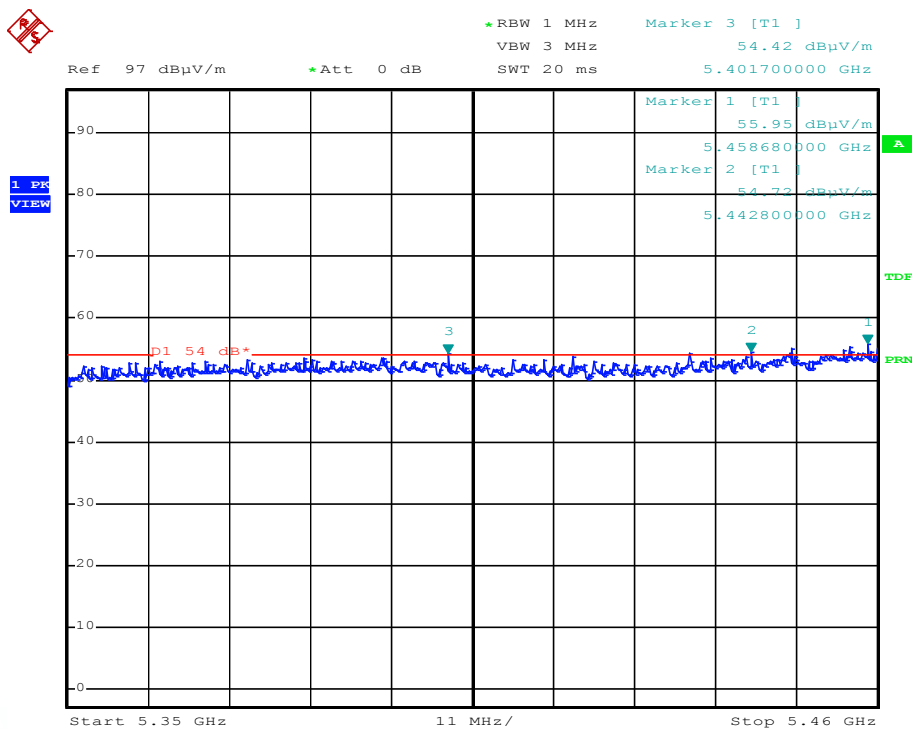


Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1] -66.31 dBm
*VBW 1 MHz SWT 200 ms 17.500000000 GHz



FCC:BV5SMALLENGINE

Peak and AV in restricted band from 5350 to 5460 MHz

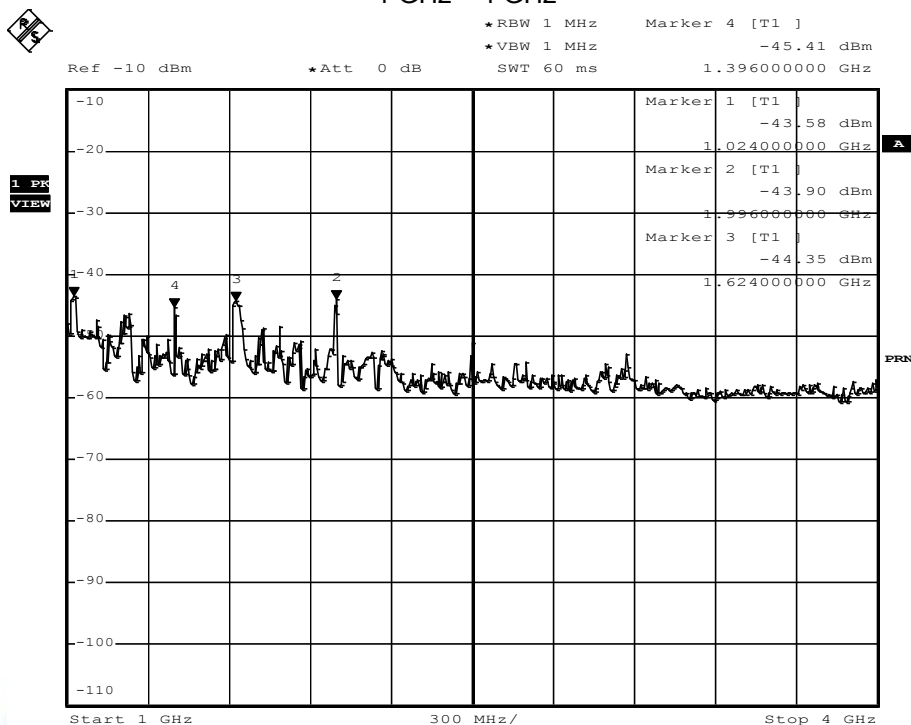


FCC:BV5SMALLENGINE

Carrier frequency at channel 140 (5700 MHz)

EUT settings: TXPOW0=2, TXPOW1=2, TXANT=0, TXMODE=3, TXMCS=0, TXBW=0, ATE=TXCONT

1 GHz – 4 GHz



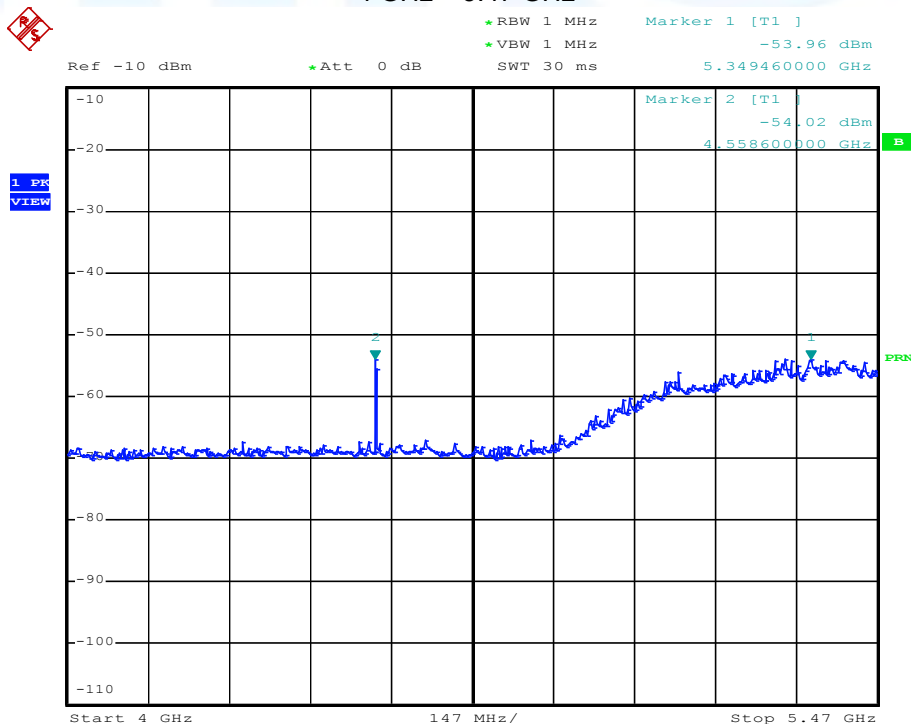
Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;

1024 MHz, -43.6 dBm → 40.6 dBμV/m;

1396 MHz, -45.4 dBm → 40.6 dBμV/m;

1624 MHz, -44.3 dBm → 41.6 dBμV/m;

4 GHz – 5.47 GHz



Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;

4558 MHz, -54.0 dBm → 50.3 dBμV/m;

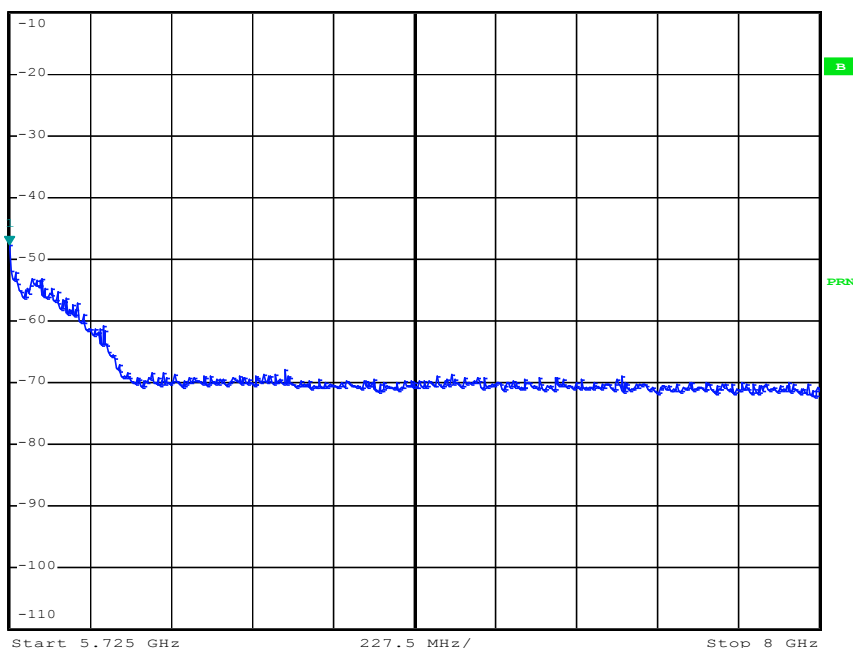
FCC:BV5SMALLENGINE

5.725 GHz – 8 GHz



1 PK
VIEW

Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -47.75 dBm
SWT 50 ms 5.725000000 GHz

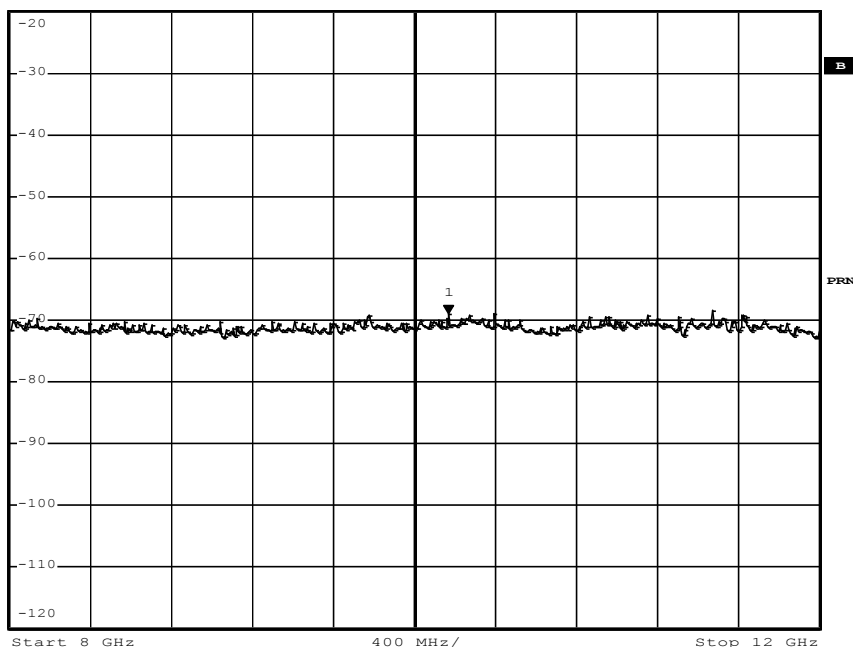


8 GHz – 12 GHz



1 PK
VIEW

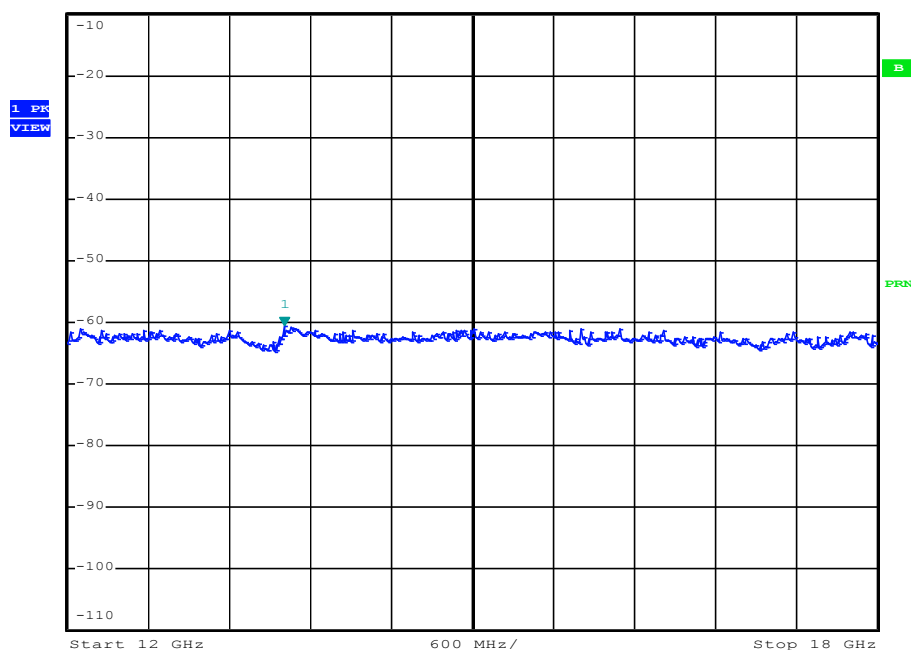
Ref -20 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -68.83 dBm
SWT 80 ms 10.168000000 GHz



FCC:BV5SMALLENGINE 12 GHz - 18 GHz



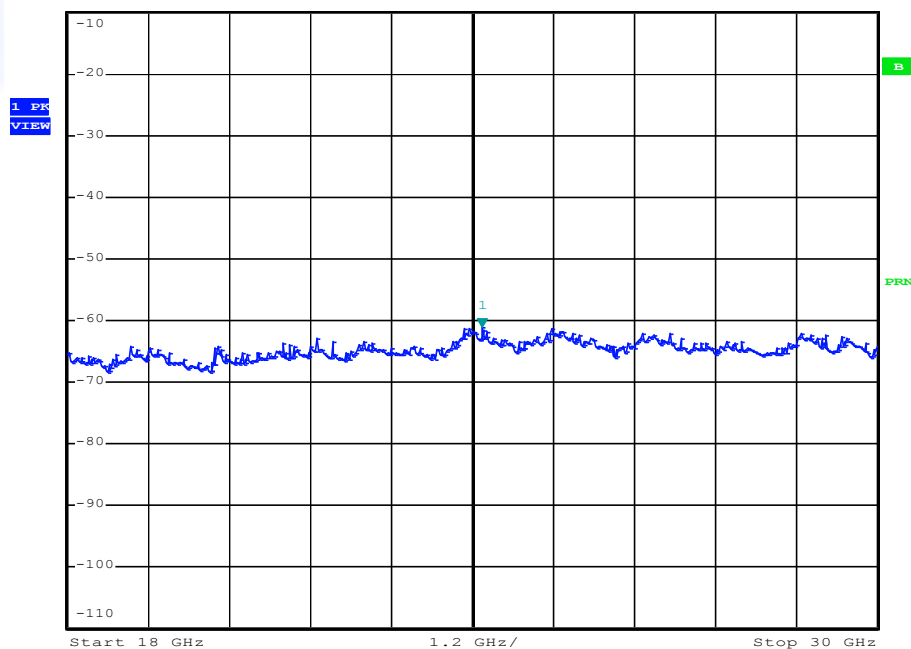
Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1] -60.46 dBm
*VBW 1 MHz SWT 120 ms 13.608000000 GHz



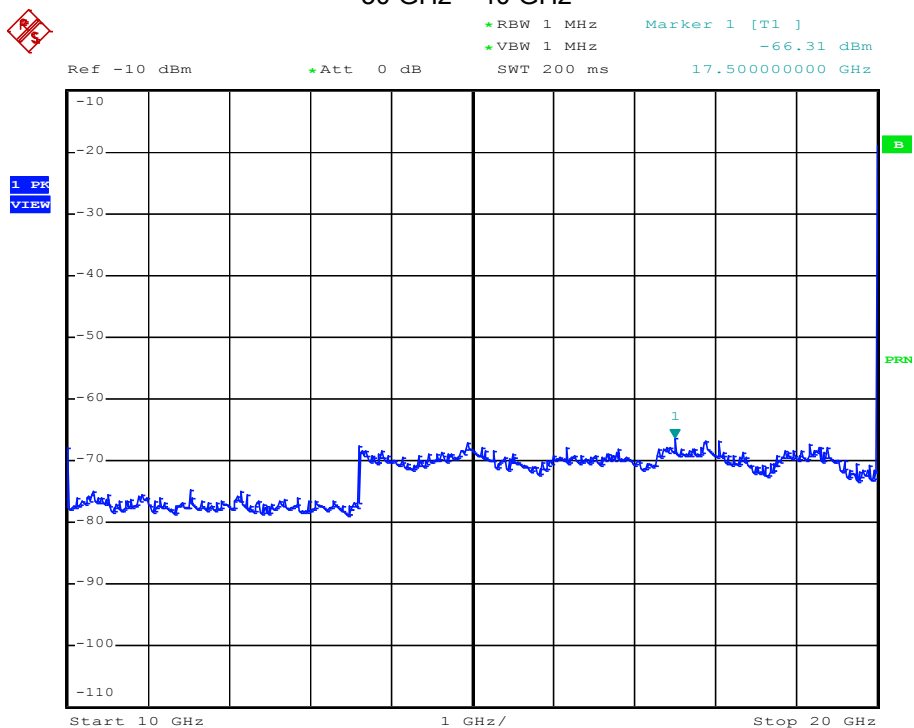
18 GHz - 30 GHz



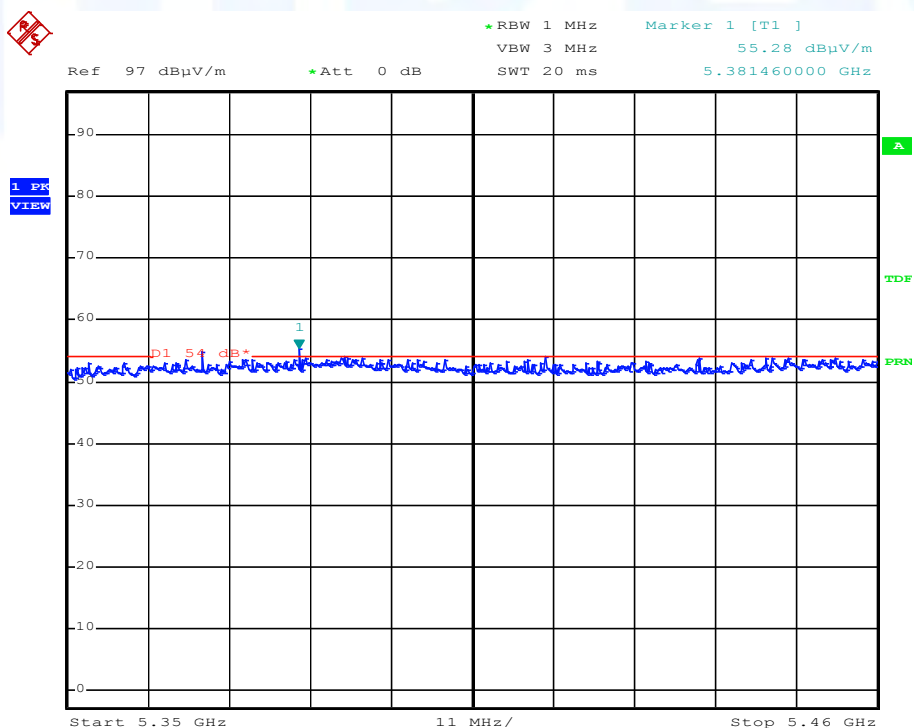
Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1] -60.93 dBm
*VBW 1 MHz SWT 240 ms 24.144000000 GHz



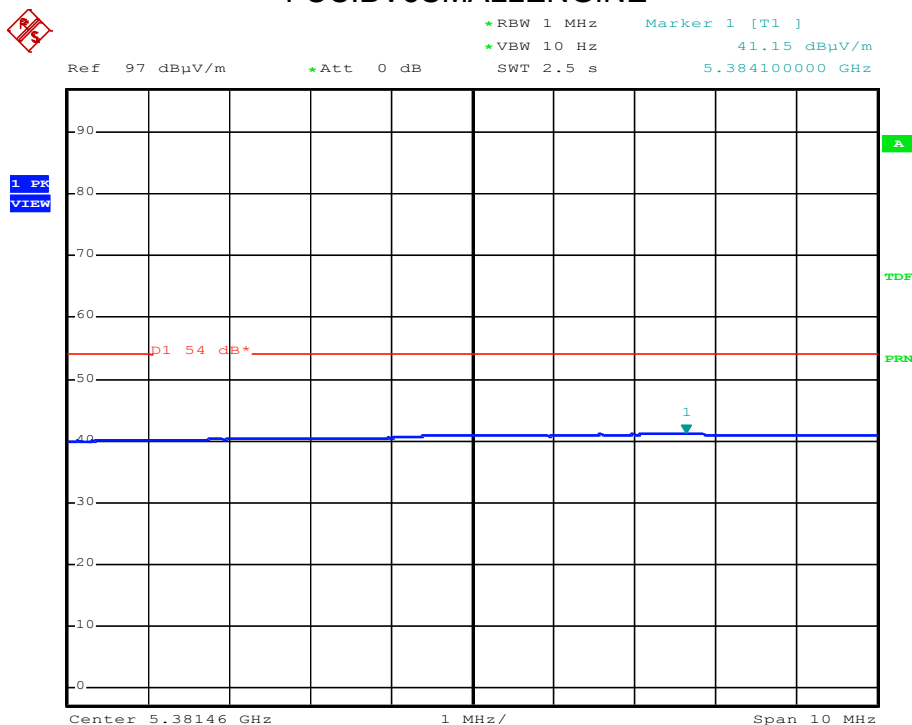
FCC:BV5SMALLENGINE 30 GHz – 40 GHz



Peak and AV plot in restricted band from 5350 to 5460 MHz



FCC:BV5SMALLENGINE



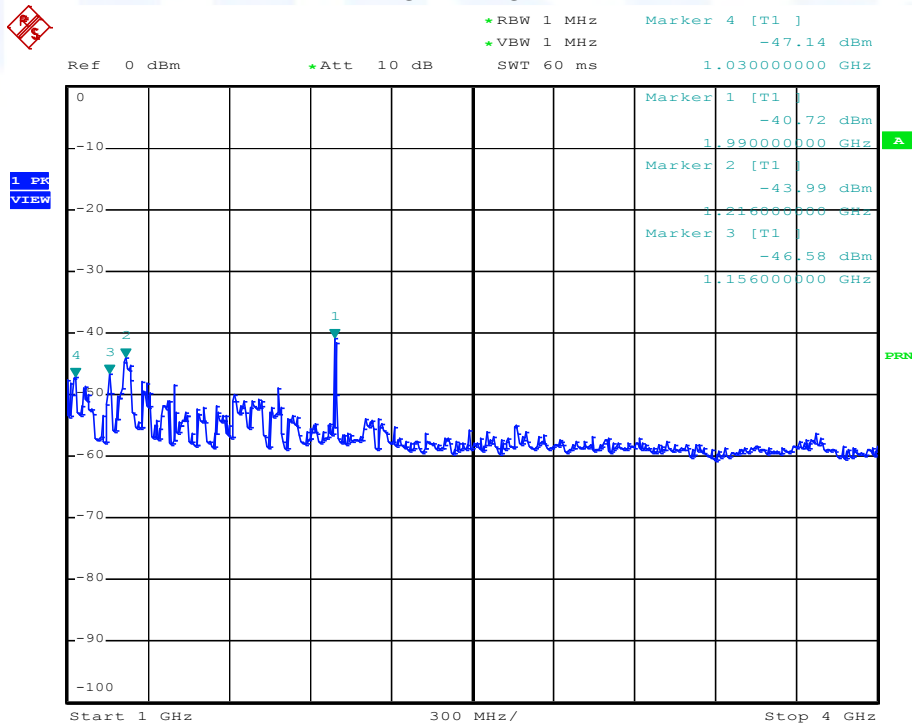
HT40:

Frequency band from 5.15 GHz to 5.25 GHz

Channel 38 (5190 MHz)

EUT settings: TXPOW0=3, TXPOW1=5, TXANT=0, TXMODE=3, TXMCS=8, TXBW=1, ATE=TXCONT

1 GHz – 4 GHz



Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;

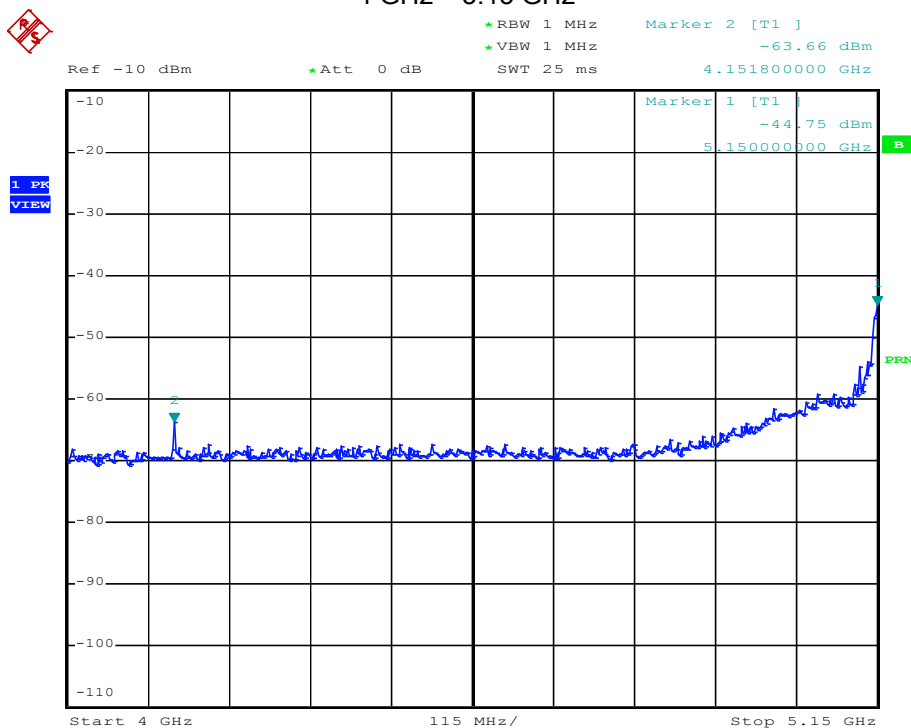
1030 MHz, -47.1 dBm → 37.2 dBμV/m;

1156 MHz, -46.6 dBm → 38.1 dBμV/m;

1216 MHz, -44.0 dBm → 40.8 dBμV/m;

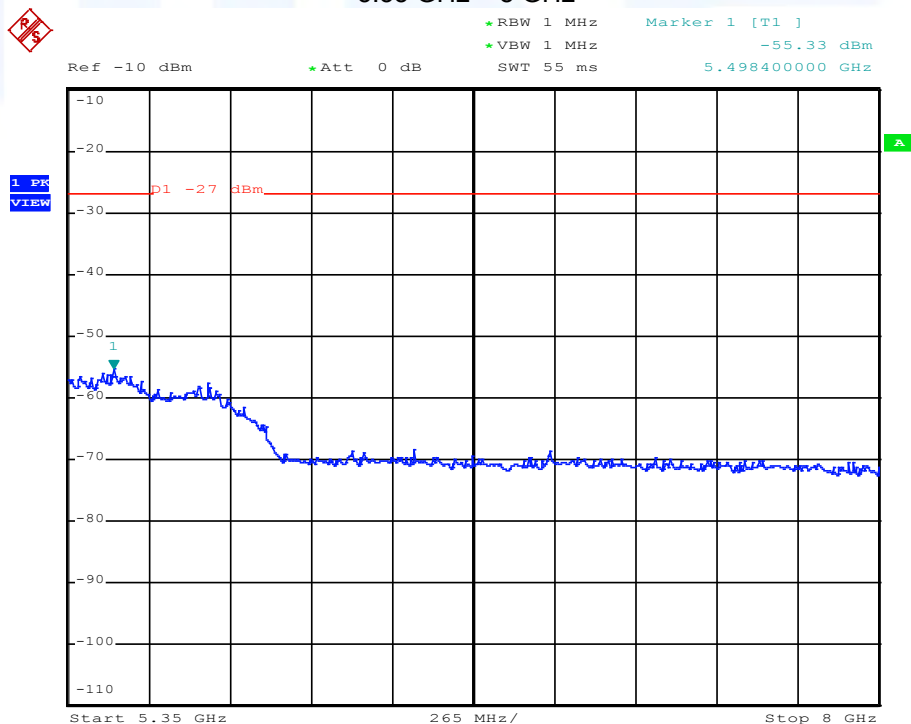
FCC:BV5SMALLENGINE

4 GHz – 5.15 GHz



Estimation of the Field strength for restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;
4151 MHz, -63.7 dBm → 40.8 dBμV/m;

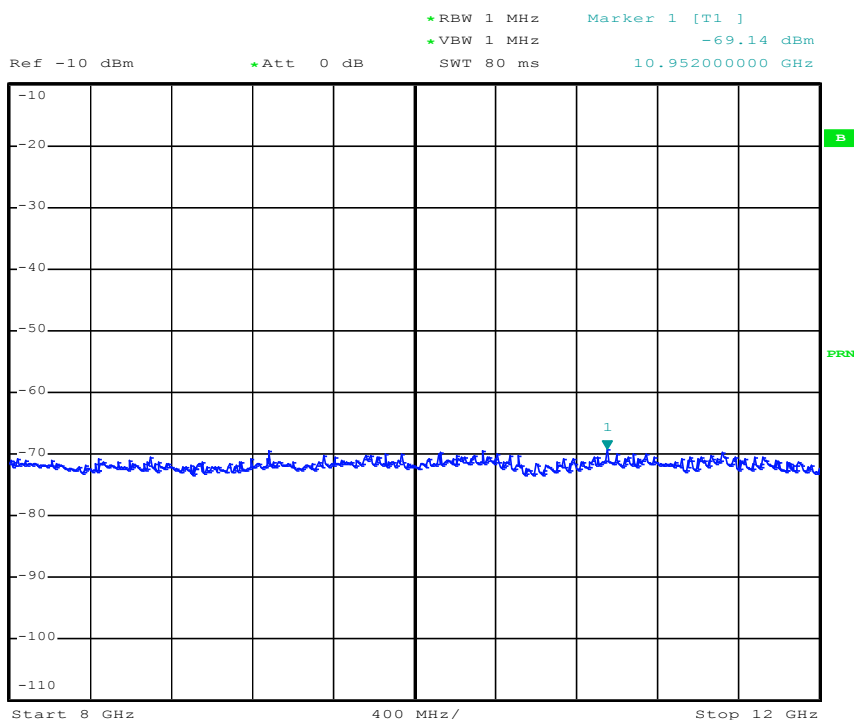
5.35 GHz – 8 GHz



FCC:BV5SMALLENGINE 8 GHz – 12 GHz



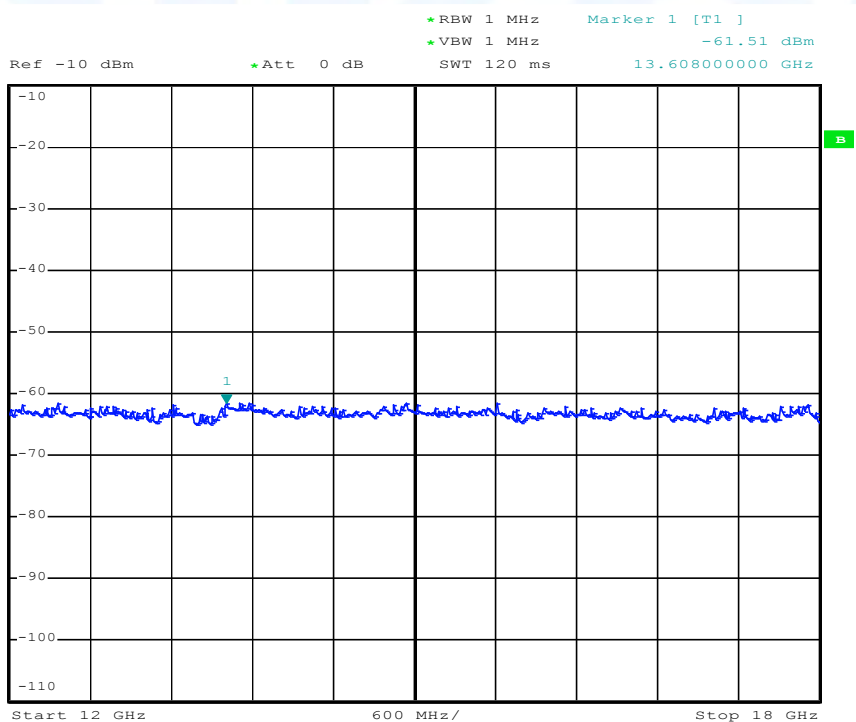
1 PK
VIEW



12 GHz - 18 GHz



1 PK
VIEW

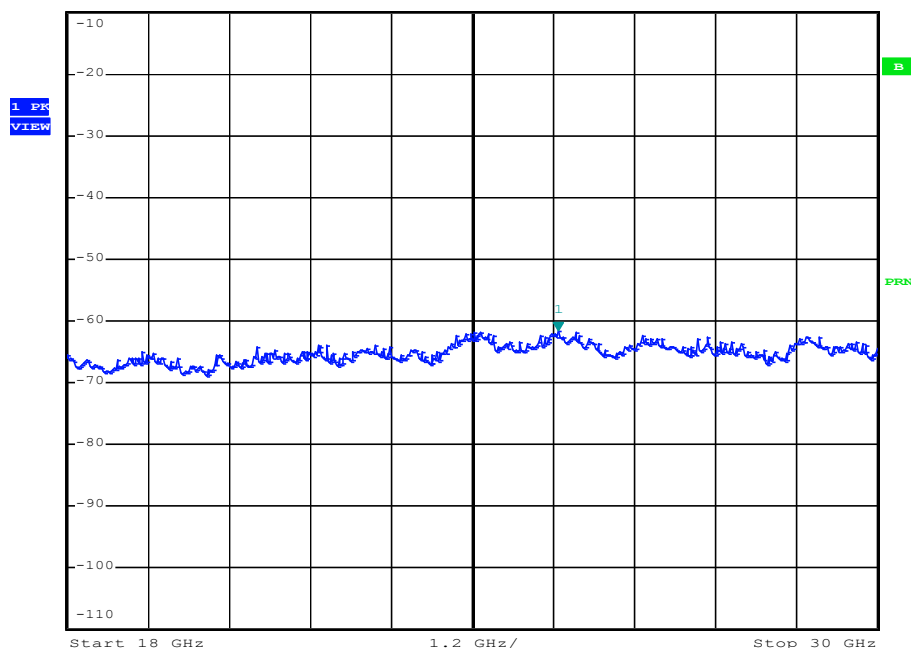


FCC:BV5SMALLENGINE

18 GHz – 30 GHz



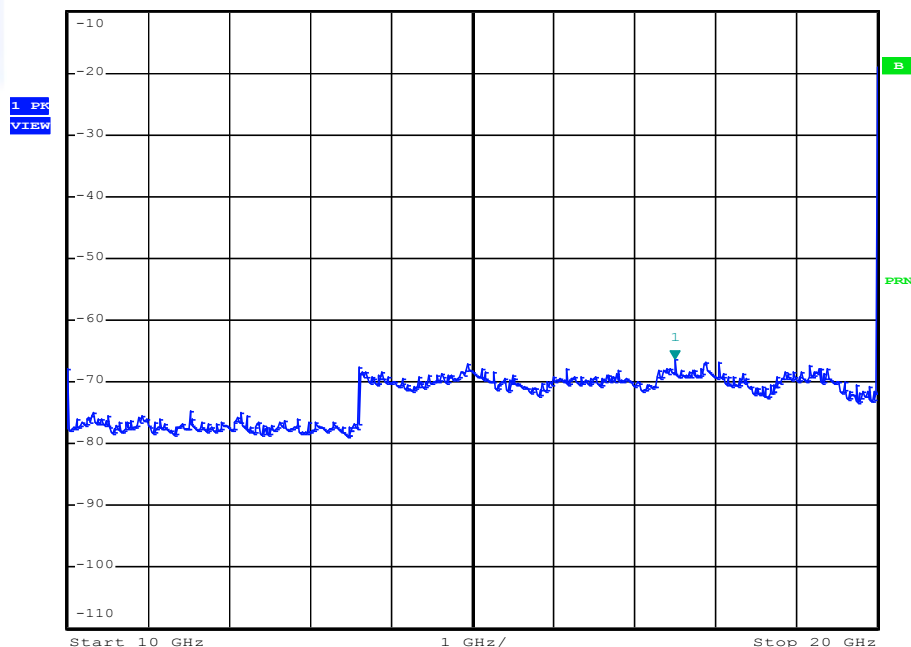
Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -61.67 dBm
SWT 240 ms 25.272000000 GHz



30 GHz – 40 GHz

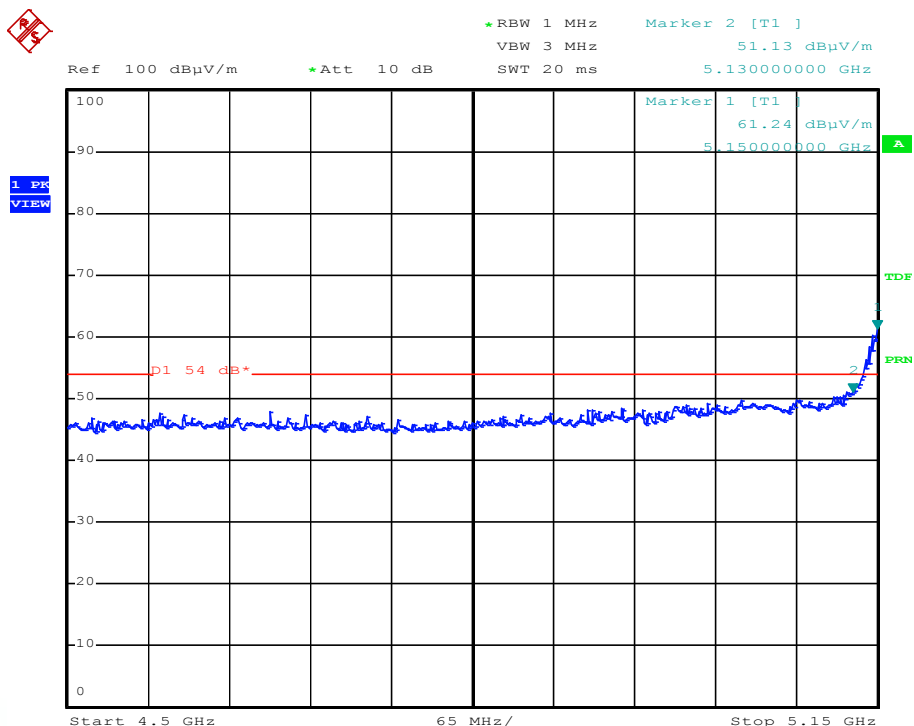


Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -66.31 dBm
SWT 200 ms 17.500000000 GHz

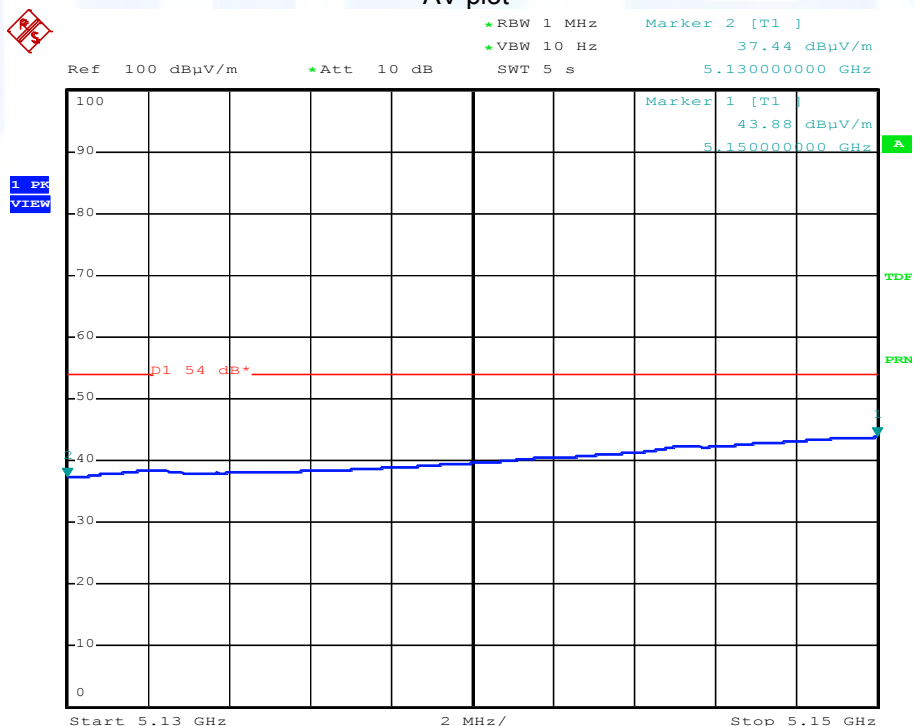


FCC:BV5SMALLENGINE

Peak and AV plot in restricted band from 4500 to 5150 MHz



AV plot



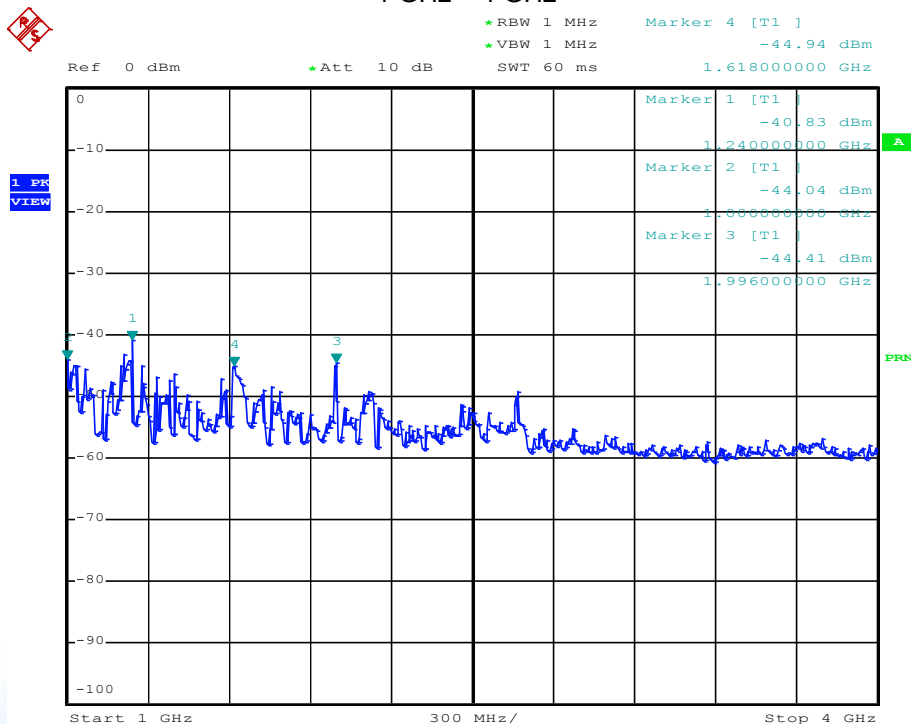
FCC:BV5SMALLENGINE

Frequency band from 5.15 GHz to 5.25 GHz:

Channel 46 (5230 MHz)

EUT settings: TXPOW0=2, TXPOW1=3, TXANT=0, TXMODE=3, TXMCS=8, TXBW=1, ATE=TXCONT

1 GHz – 4 GHz

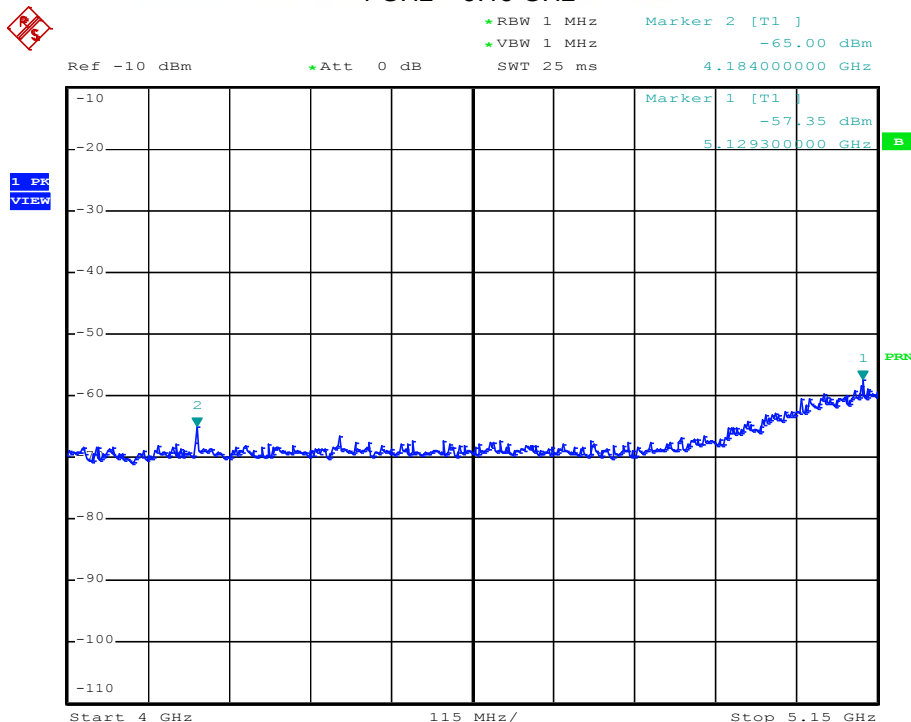


Estimation of the Field strength for restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;

1240 MHz, -40.8 dBm → 44.4 dBμV/m;

1618 MHz, -44.9 dBm → 40.9 dBμV/m;

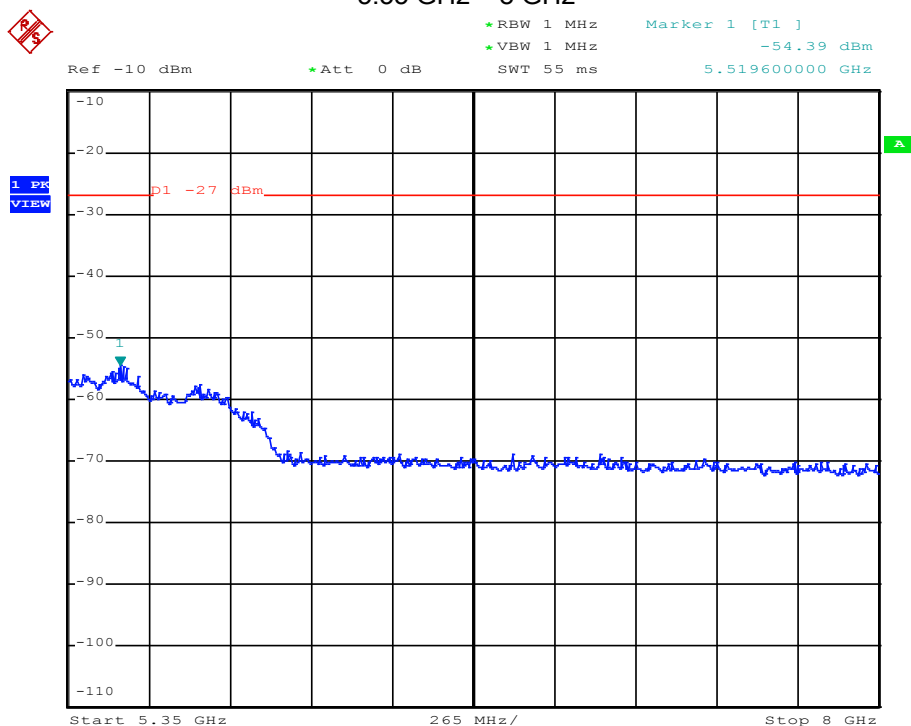
4 GHz – 5.15 GHz



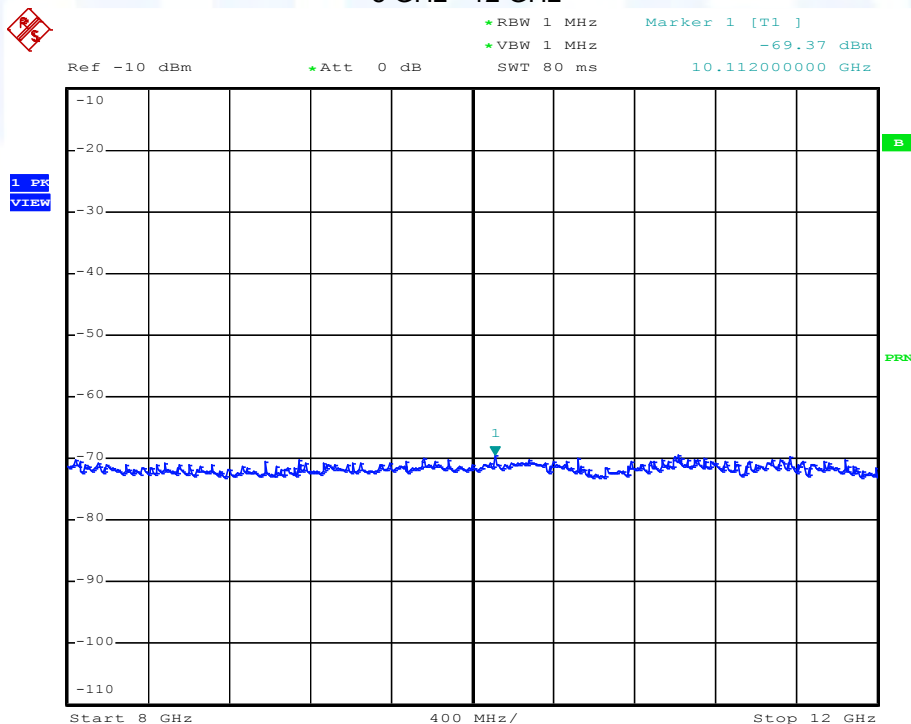
4184 MHz, -65.0 dBm → 39.1 dBμV/m;

FCC:BV5SMALLENGINE

5.35 GHz – 8 GHz



8 GHz - 12 GHz

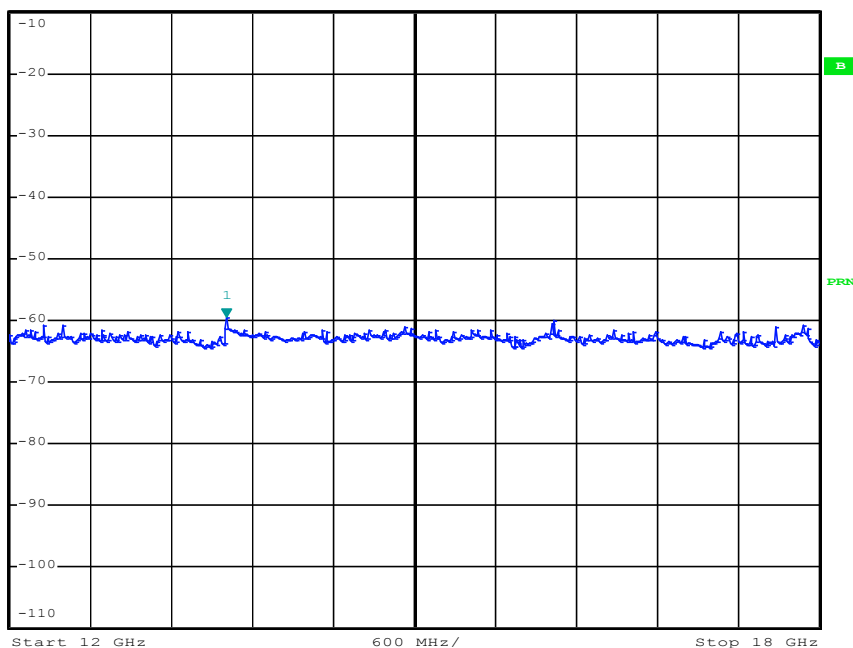


FCC:BV5SMALLENGINE 12 GHz - 18 GHz



1 PK
VIEW

Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -59.58 dBm
SWT 120 ms 13.608000000 GHz

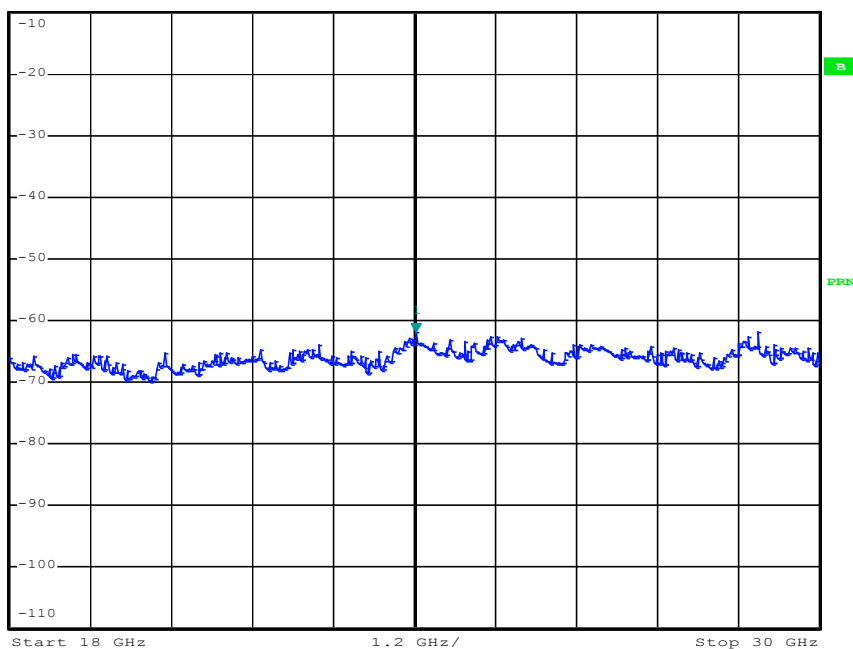


18 GHz – 30 GHz

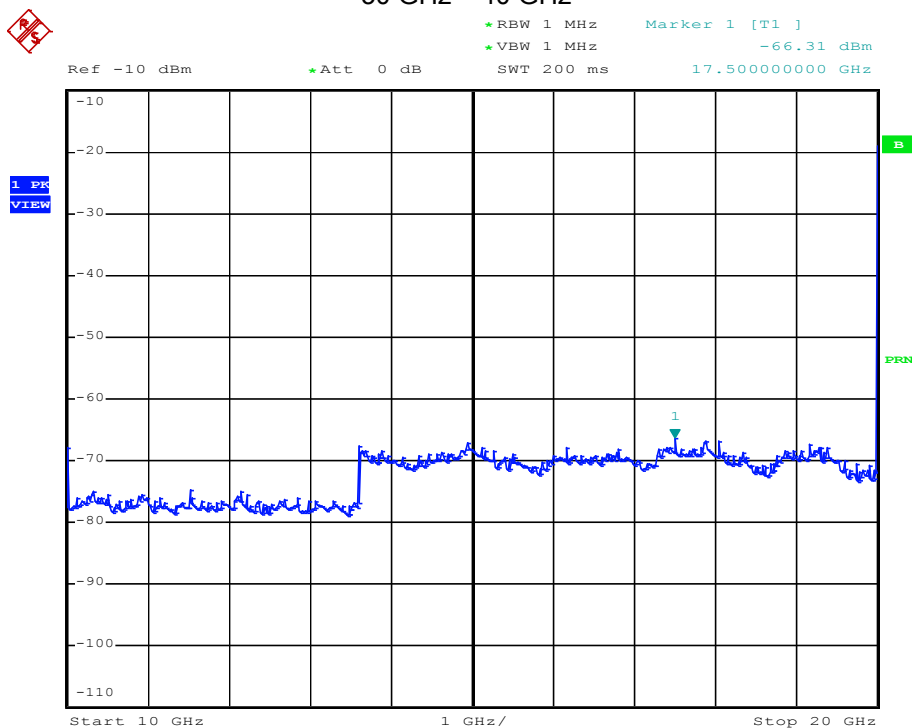


1 PK
VIEW

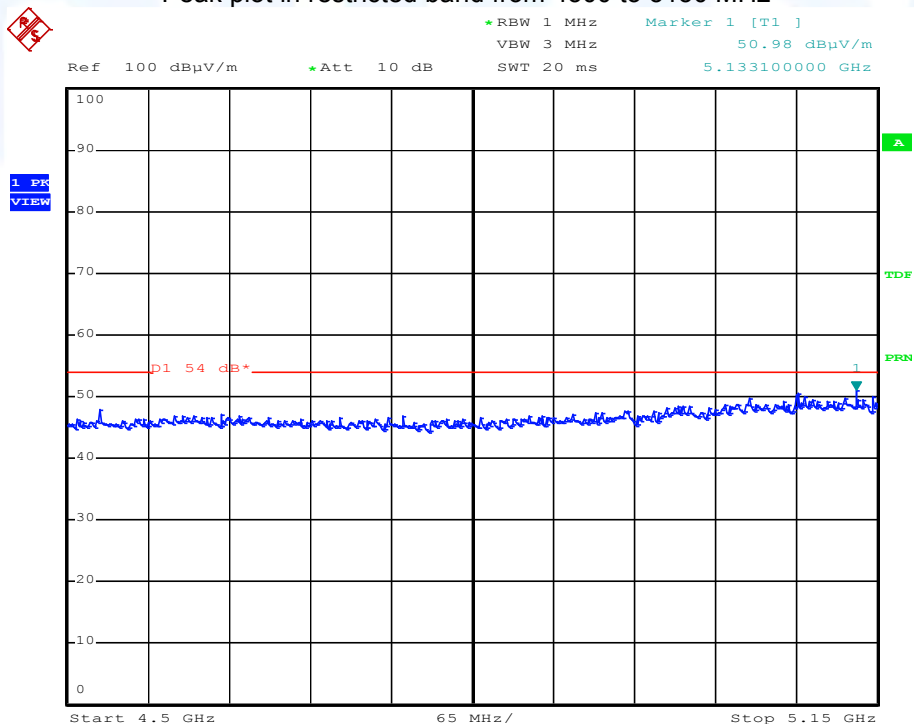
Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -61.79 dBm
SWT 240 ms 24.024000000 GHz



FCC:BV5SMALLENGINE 30 GHz – 40 GHz



Peak plot in restricted band from 4500 to 5150 MHz



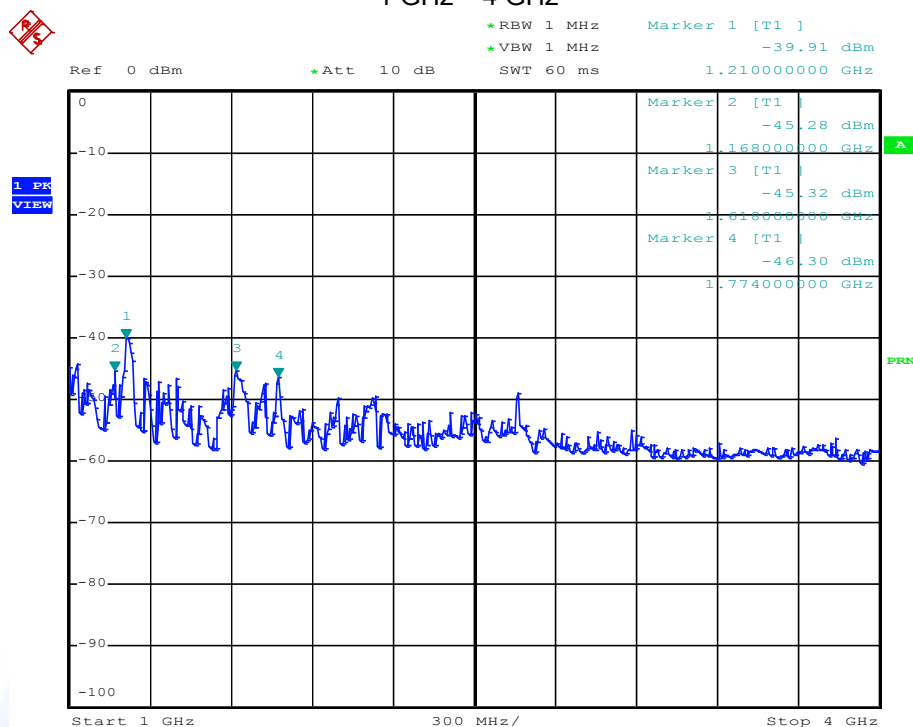
FCC:BV5SMALLENGINE

Frequency band from 5.25 GHz to 5.35 GHz:

Channel 54 (5270 MHz)

EUT settings: TXPOW0=1, TXPOW1=2, TXANT=0, TXMODE=3, TXMCS=8, TXBW=1, ATE=TXCONT

1 GHz – 4 GHz



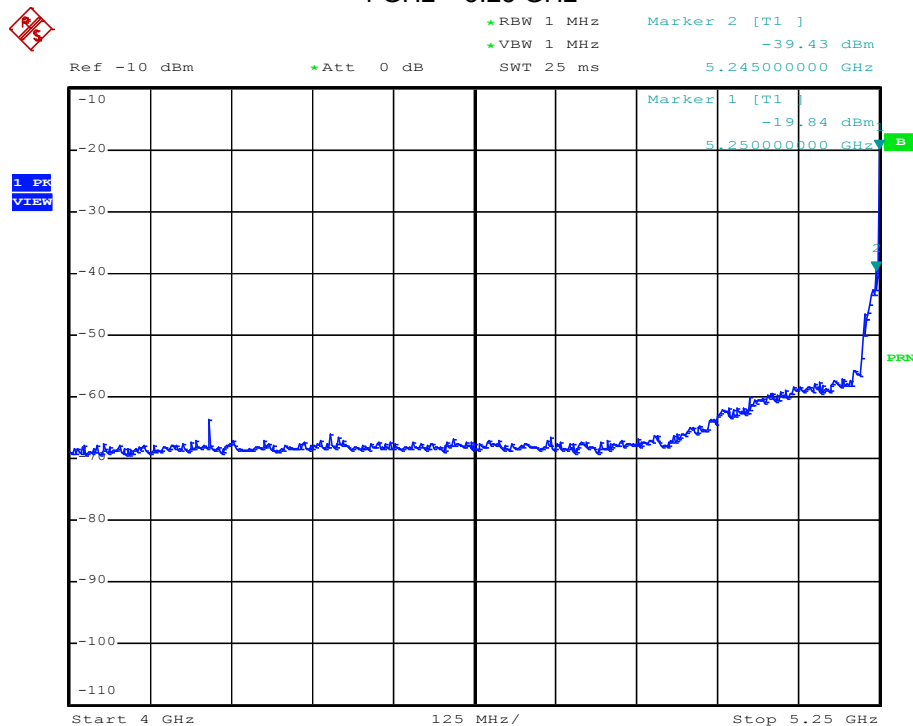
Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;

1168 MHz, -45.3 dBm → 39.3 dBμV/m;

1210 MHz, -39.9 dBm → 44.8 dBμV/m;

1618 MHz, -46.3 dBm → 39.5 dBμV/m;

4 GHz – 5.25 GHz

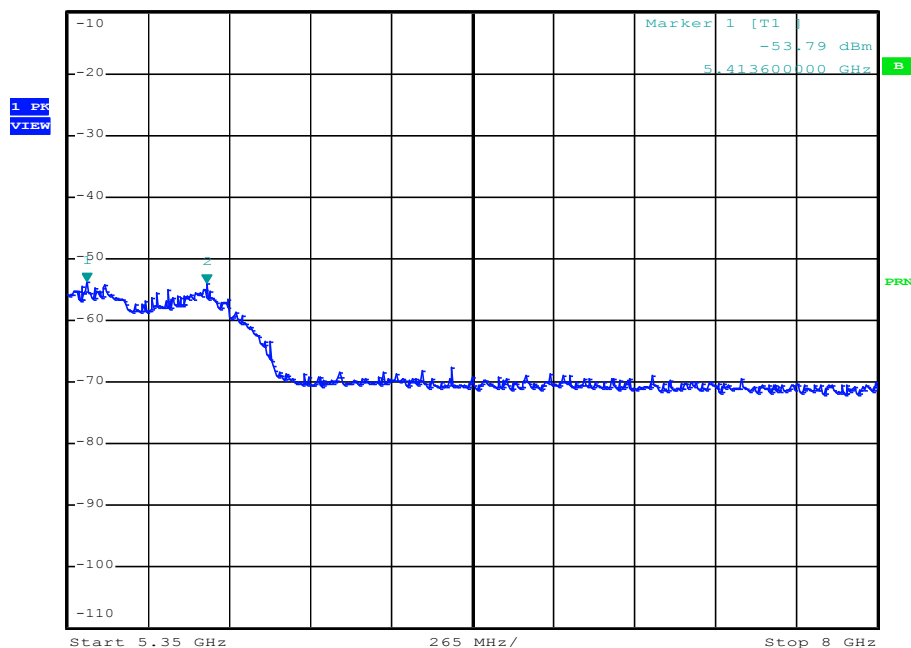


FCC:BV5SMALLENGINE

5.35 GHz – 8 GHz



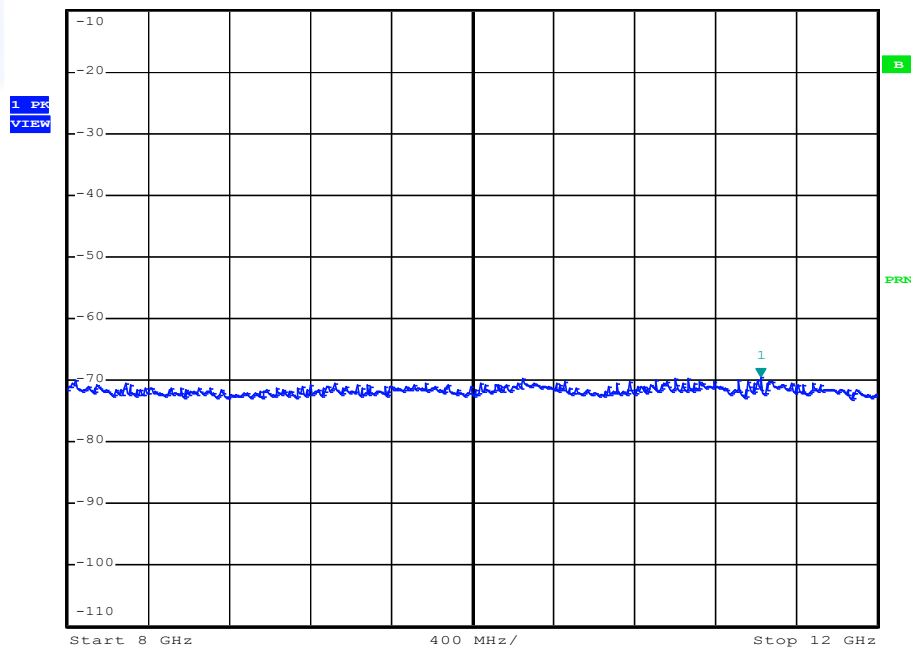
Ref -10 dBm *Att 0 dB *RBW 1 MHz *VBW 1 MHz Marker 2 [T1] -53.99 dBm
SWT 55 ms 5.805800000 GHz



8 GHz – 12 GHz



Ref -10 dBm *Att 0 dB *RBW 1 MHz *VBW 1 MHz Marker 1 [T1] -69.37 dBm
SWT 80 ms 11.424000000 GHz

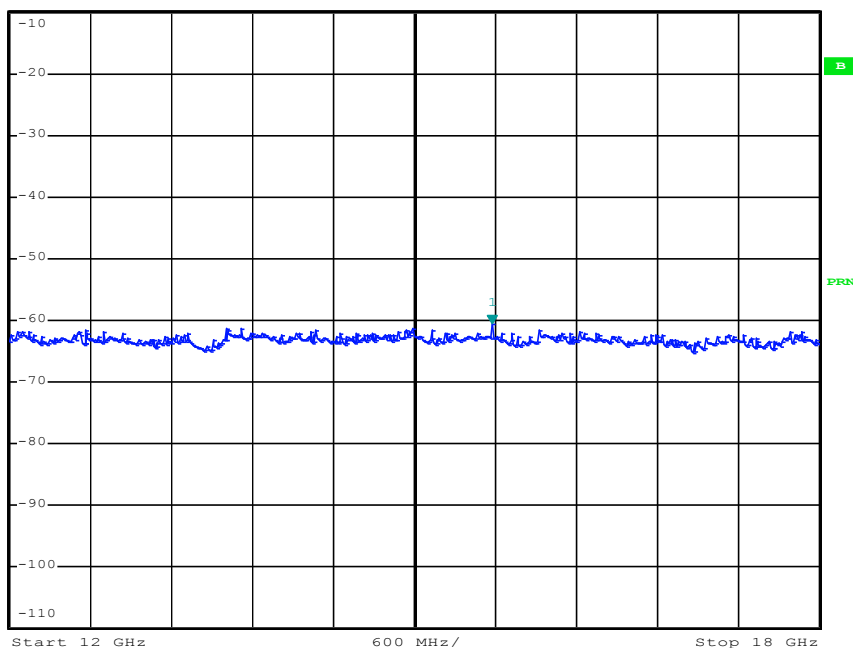


FCC:BV5SMALLENGINE 12 GHz - 18 GHz



1 PK
VIEW

Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -60.59 dBm
SWT 120 ms 15.576000000 GHz

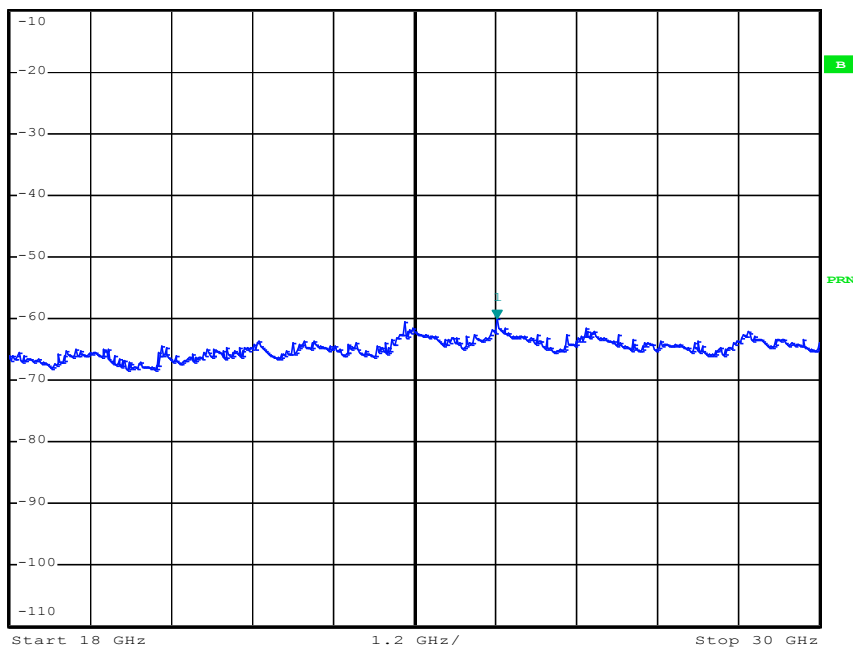


18 GHz – 30 GHz

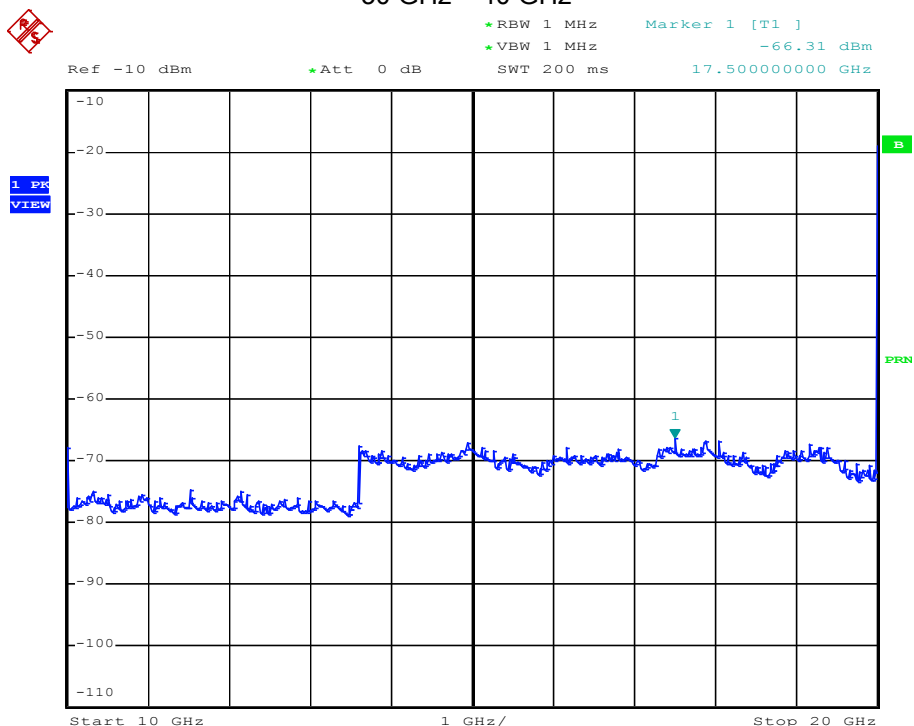


1 PK
VIEW

Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -60.13 dBm
SWT 240 ms 25.224000000 GHz

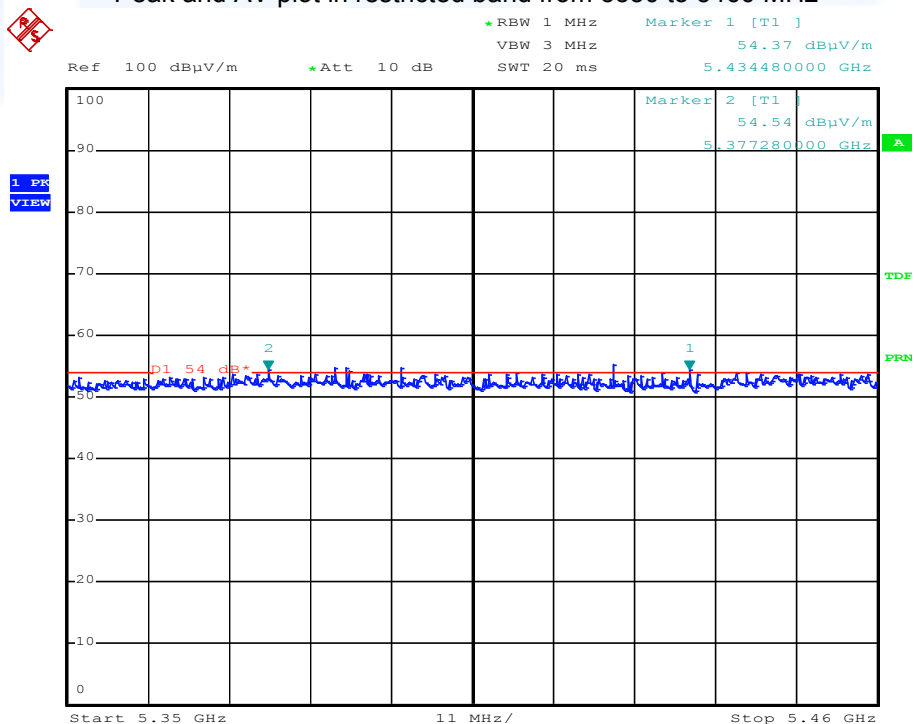


FCC:BV5SMALLENGINE 30 GHz – 40 GHz



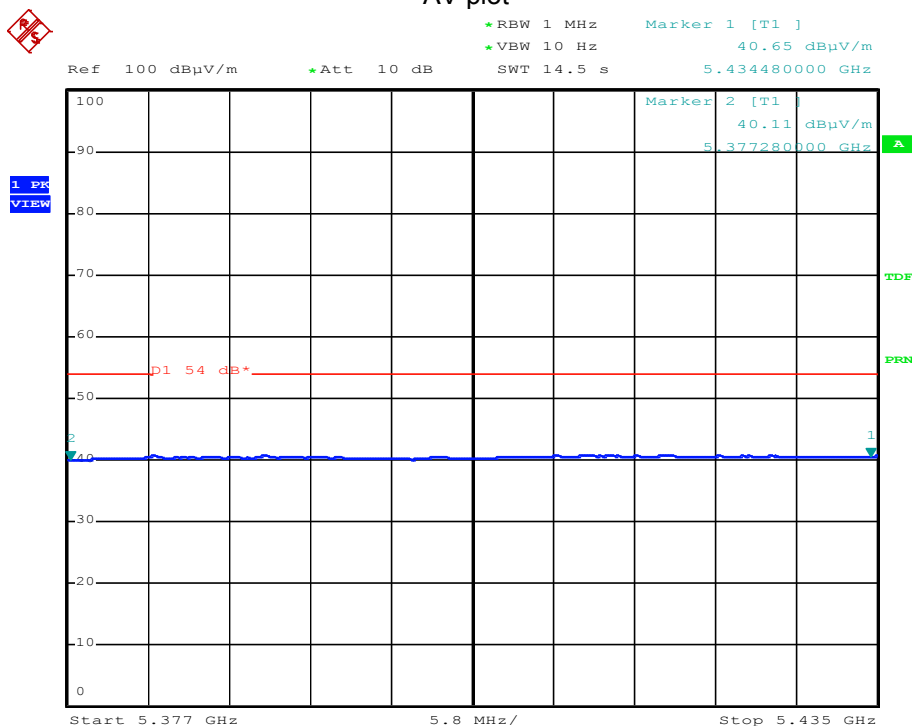
Restricted band emission levels at the upper band edge.

Peak and AV plot in restricted band from 5350 to 5460 MHz



FCC:BV5SMALLENGINE

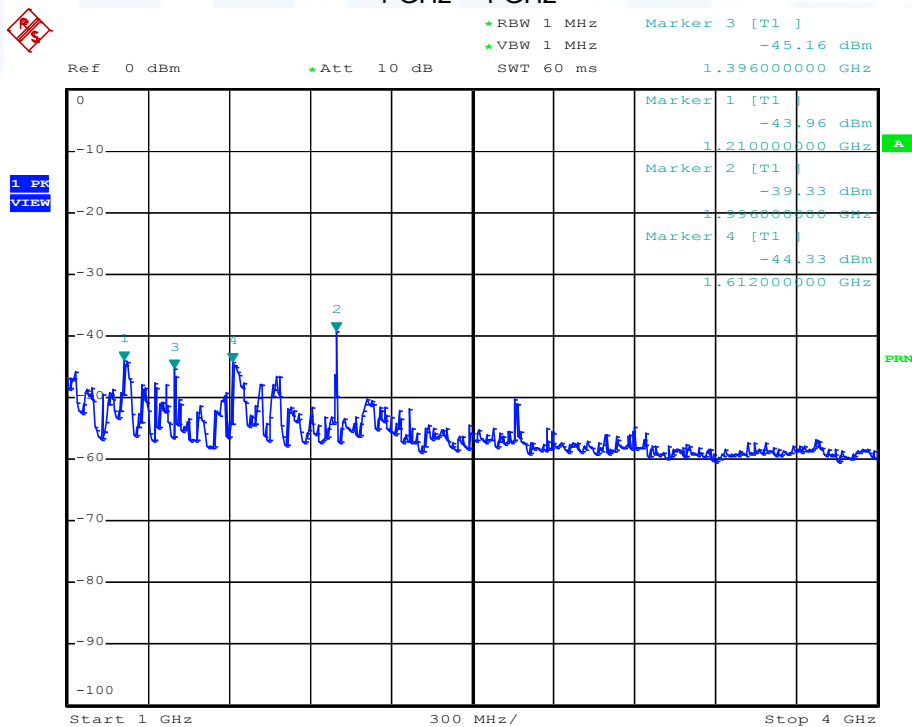
AV plot



Channel 62 (5310 MHz)

EUT settings: TXPOW0=1, TXPOW1=2, TXANT=0, TXMODE=3, TXMCS=8, TXBW=1, ATE=TXCONT

1 GHz – 4 GHz



Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;

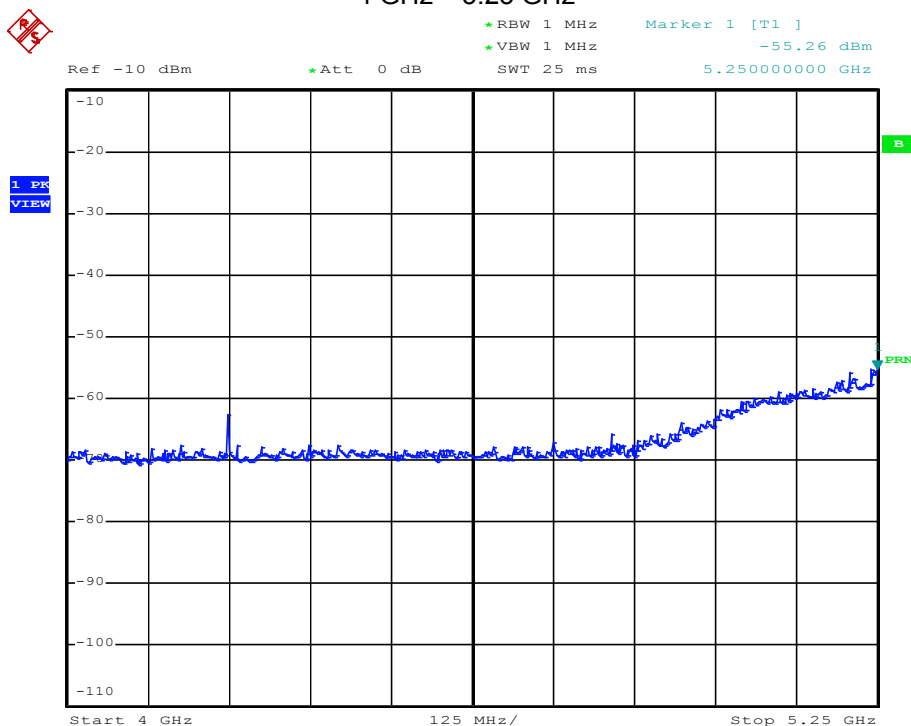
1210 MHz, -44 dBm → 40.7 dBμV/m;

1396 MHz, -39.3 dBm → 46.7 dBμV/m;

1612 MHz, -44.3 dBm → 41.5 dBμV/m;

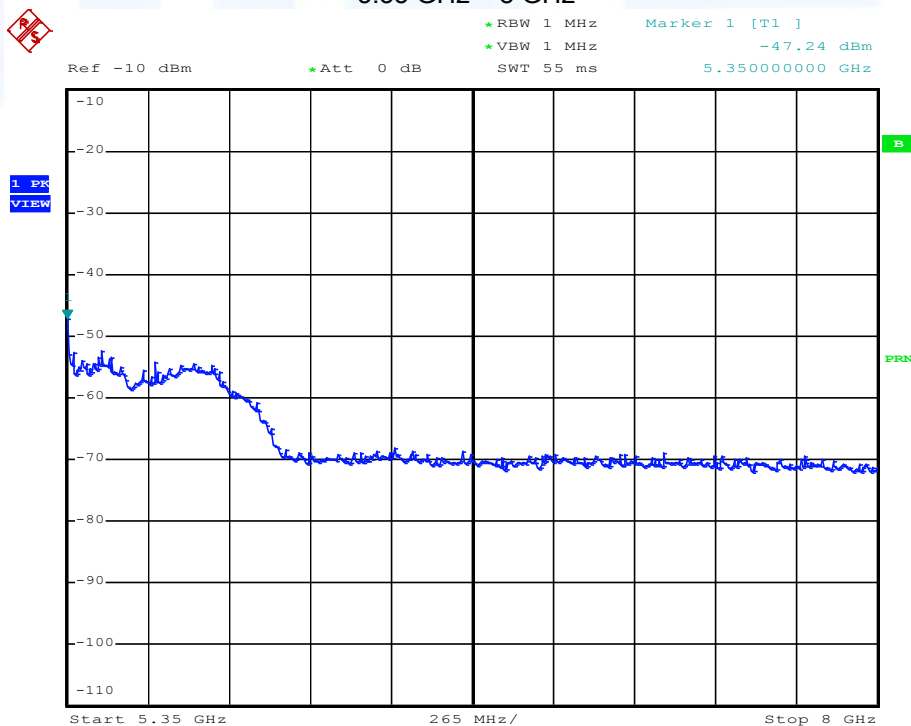
FCC:BV5SMALLENGINE

4 GHz – 5.25 GHz

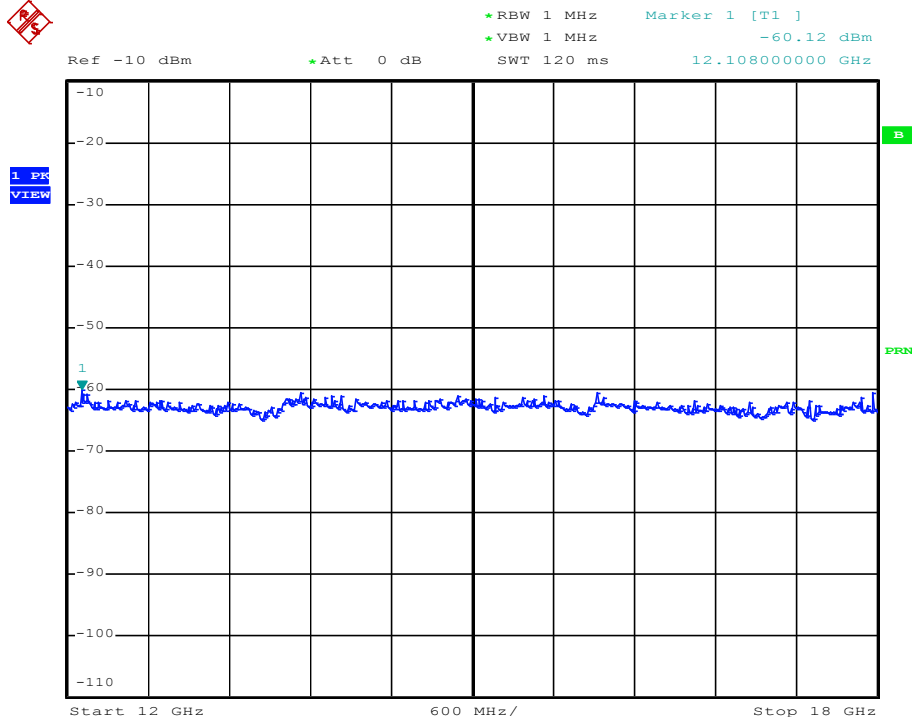


Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;
4248 MHz, -64.0 dBm → 39.7 dBμV/m;

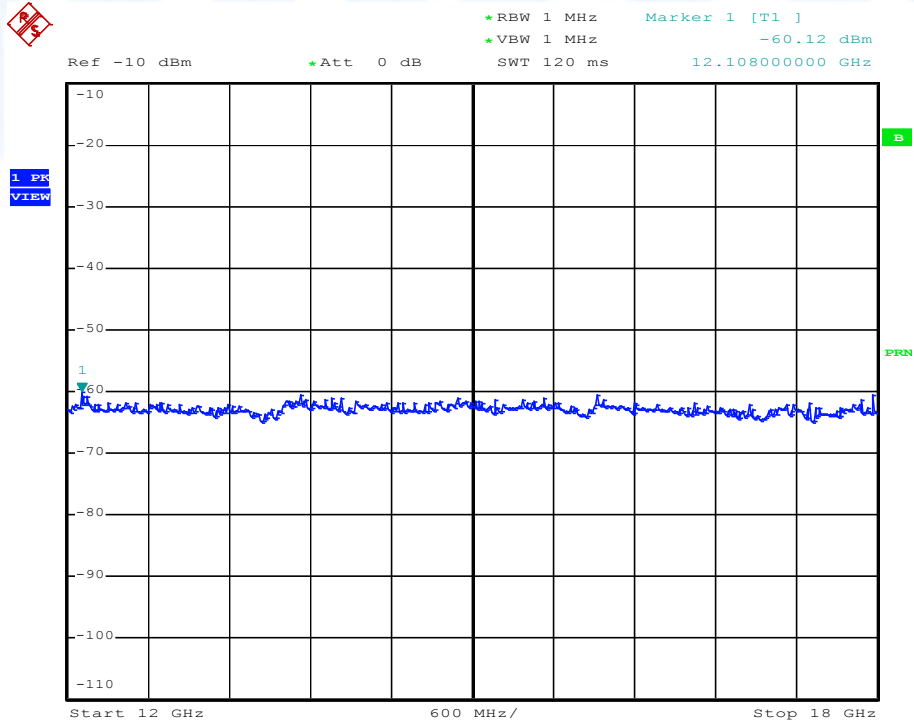
5.35 GHz – 8 GHz



FCC:BV5SMALLENGINE 8 GHz – 12 GHz



12 GHz - 18 GHz



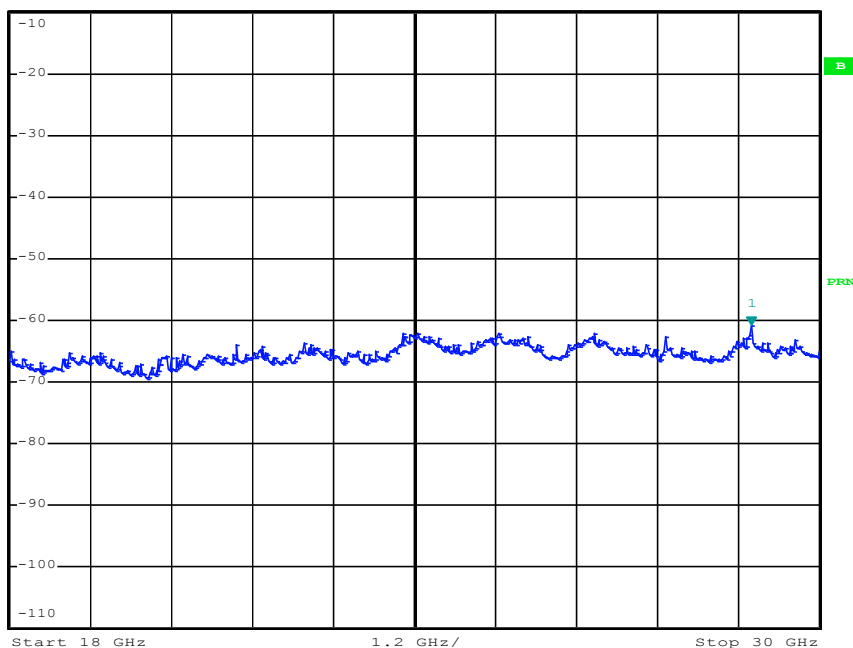
FCC:BV5SMALLENGINE

18 GHz – 30 GHz



1 PK
VIEW

Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -60.88 dBm
SWT 240 ms 28.992000000 GHz

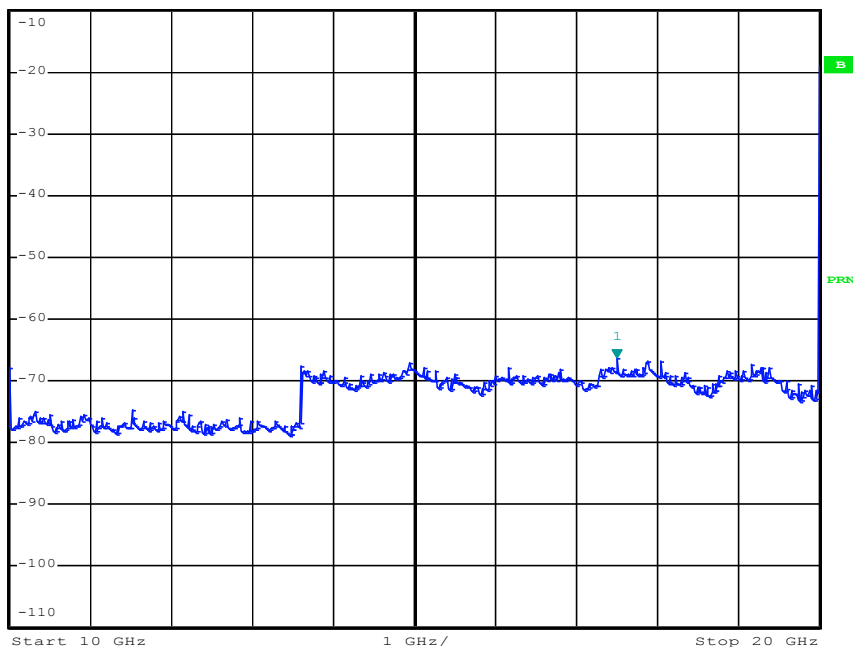


30 GHz – 40 GHz



1 PK
VIEW

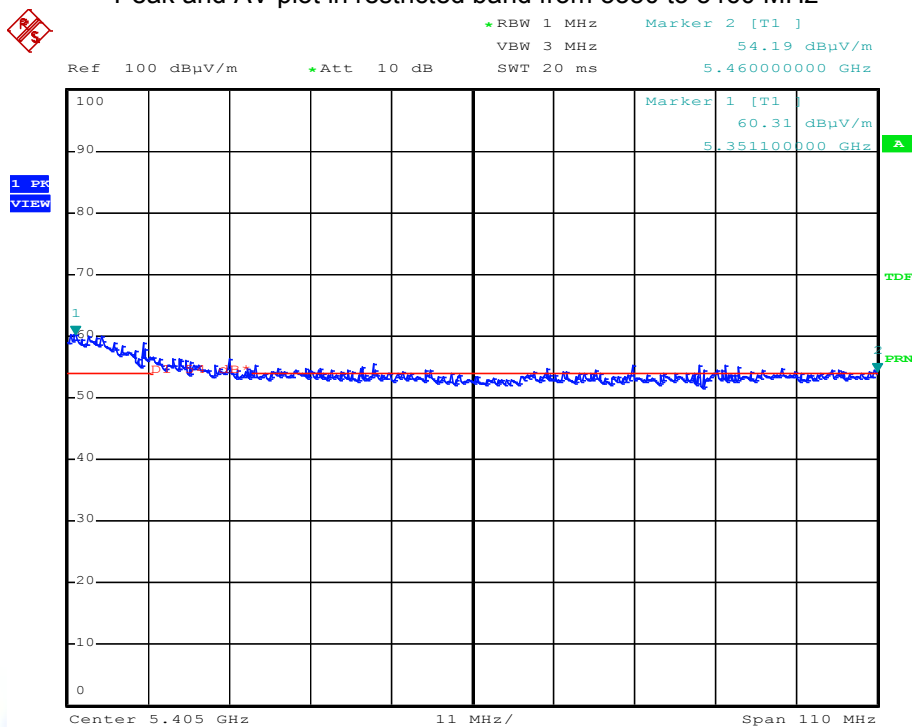
Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -66.31 dBm
SWT 200 ms 17.500000000 GHz



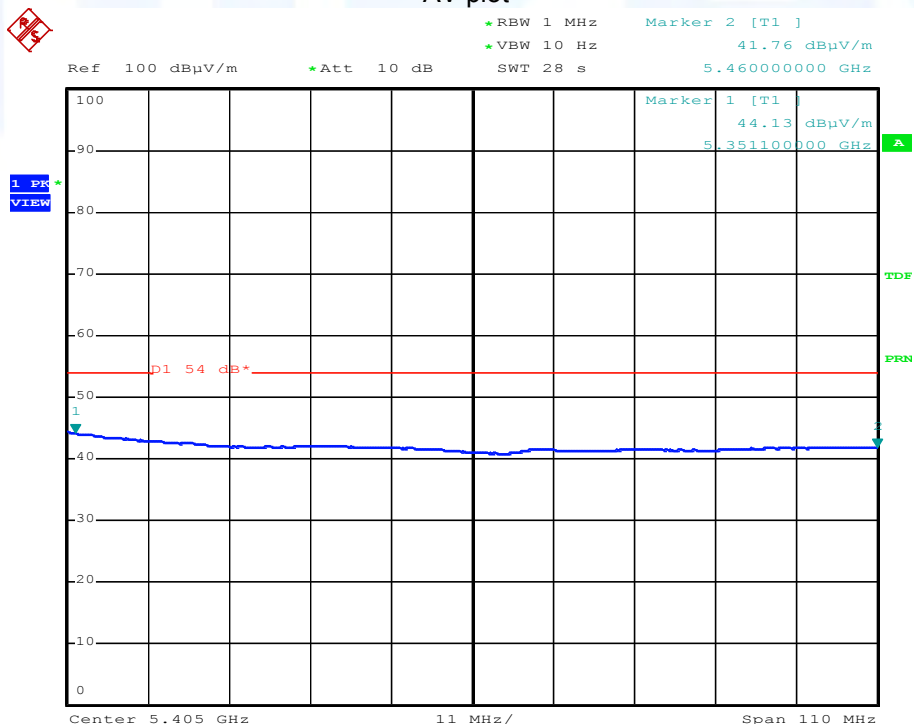
FCC:BV5SMALLENGINE

Restricted band emission levels at the upper band edge.

Peak and AV plot in restricted band from 5350 to 5460 MHz



AV plot



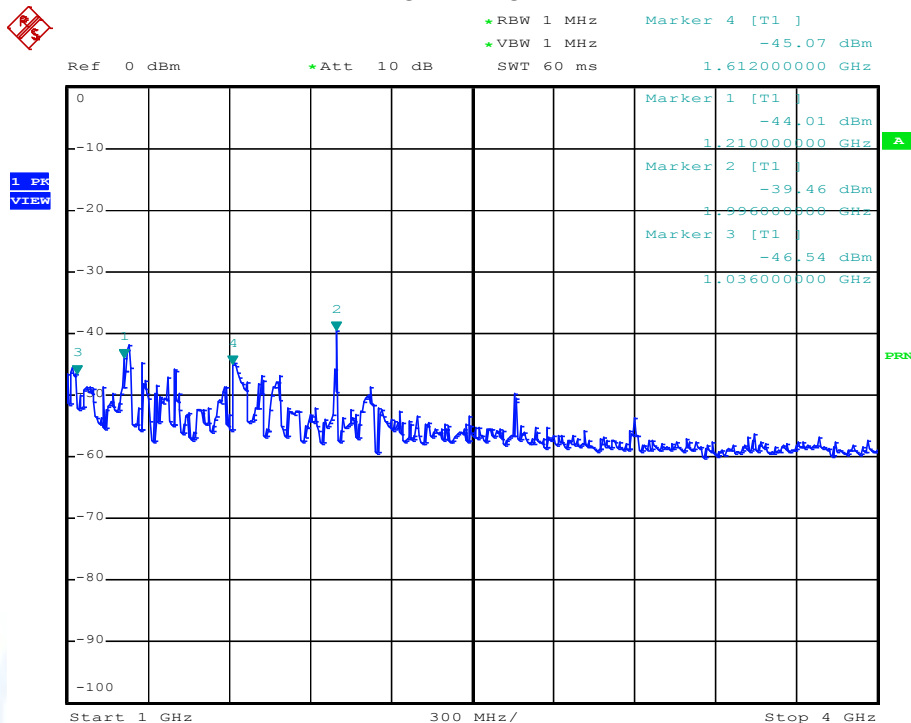
FCC:BV5SMALLENGINE

Frequency band from 5.47 GHz to 5.725 GHz:

Channel 102 (5510 MHz)

EUT settings: TXPOW0=0, TXPOW1=-2, TXANT=0, TXMODE=3, TXMCS=8, TXBW=1, ATE=TXCONT

1 GHz – 4 GHz



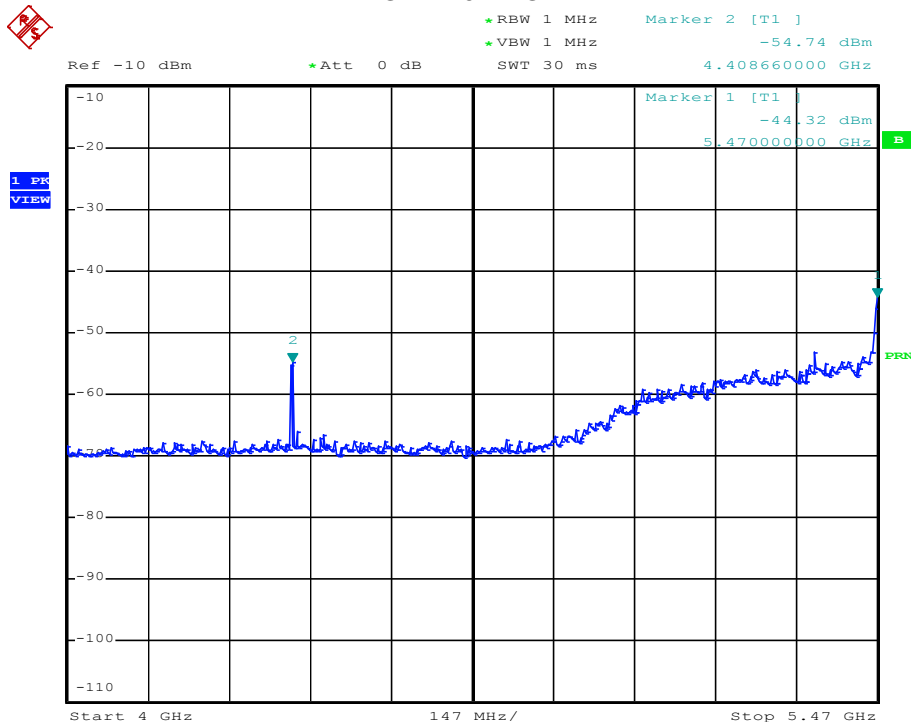
Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;

1036 MHz, -46.5 dBm → 37.8 dBμV/m;

1210 MHz, -39.5 dBm → 45.2 dBμV/m;

1612 MHz, -45.1 dBm → 41.2 dBμV/m;

4 GHz – 5.47 GHz

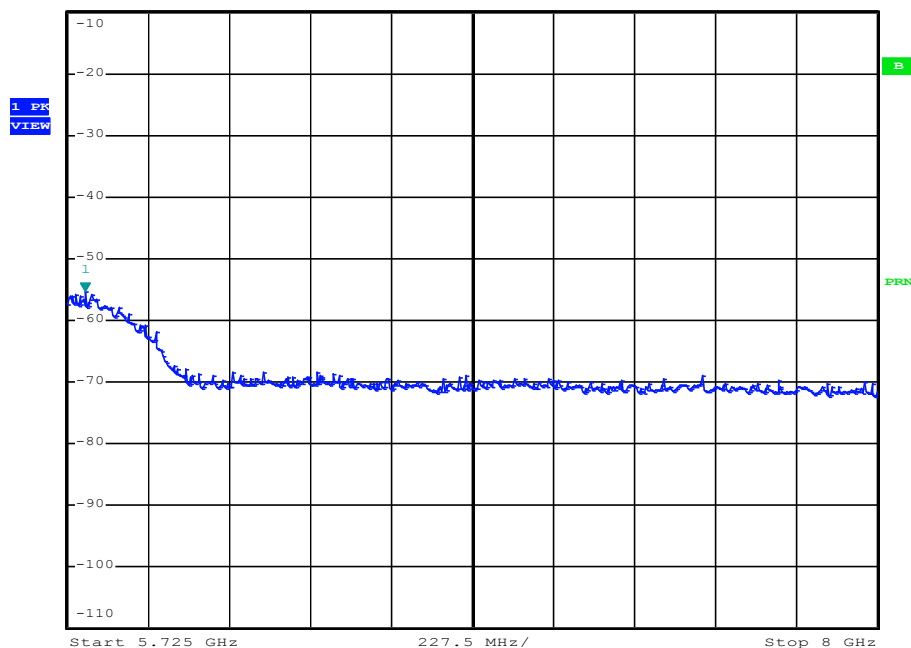


FCC:BV5SMALLENGINE

5.725 GHz – 8 GHz



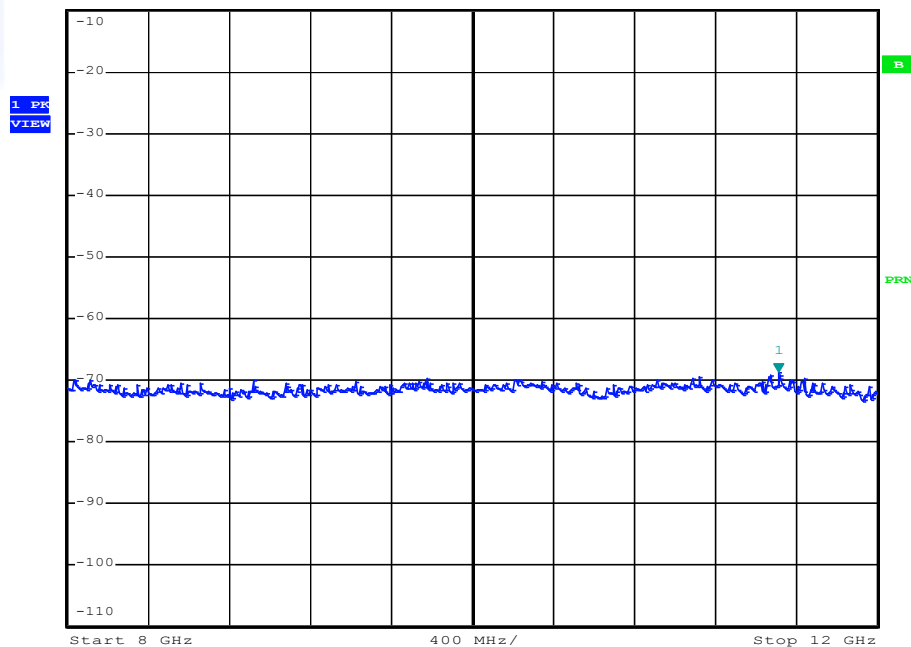
Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -55.39 dBm
SWT 50 ms 5.775050000 GHz



8 GHz – 12 GHz



Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -68.59 dBm
SWT 80 ms 11.512000000 GHz

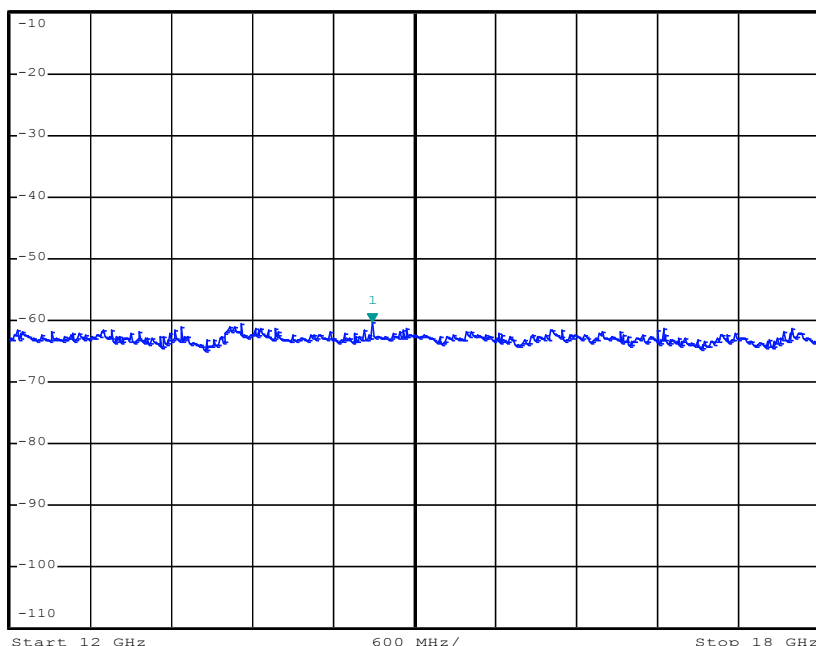


FCC:BV5SMALLENGINE 12 GHz - 18 GHz



1 PK
VIEW

Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -60.19 dBm
SWT 120 ms 14.688000000 GHz

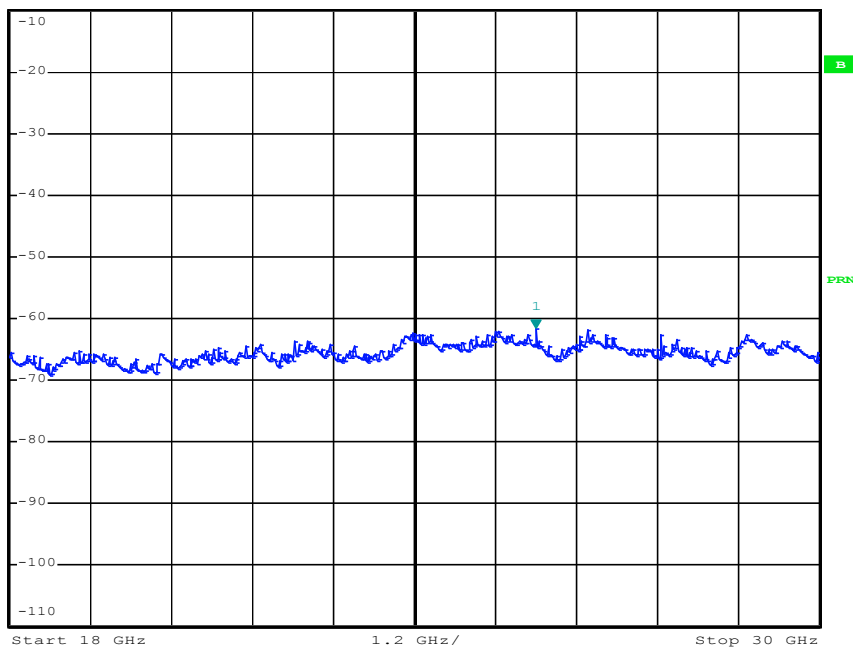


18 GHz – 30 GHz

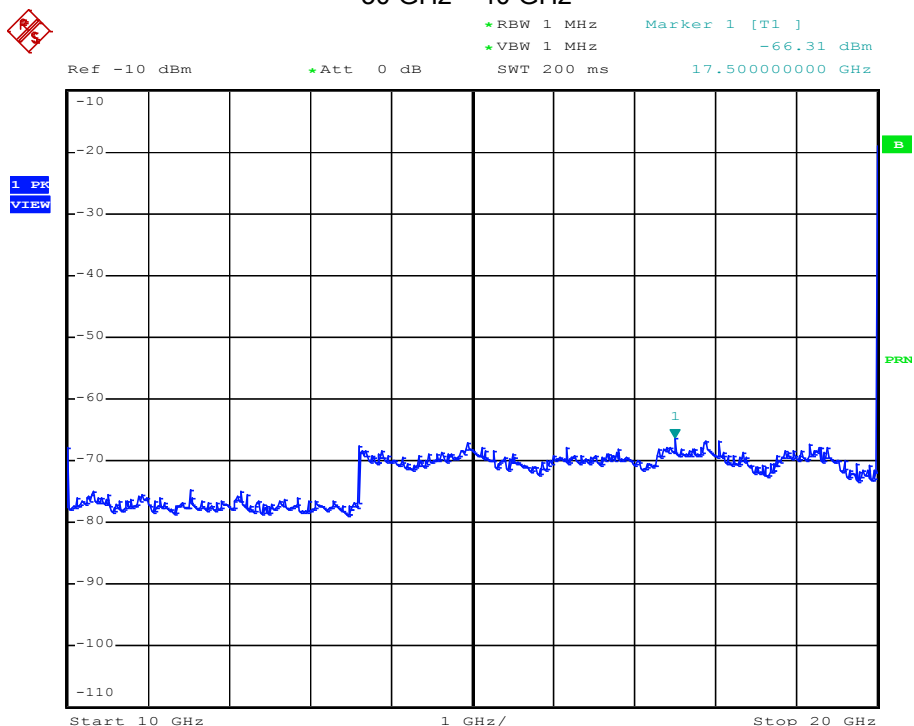


1 PK
VIEW

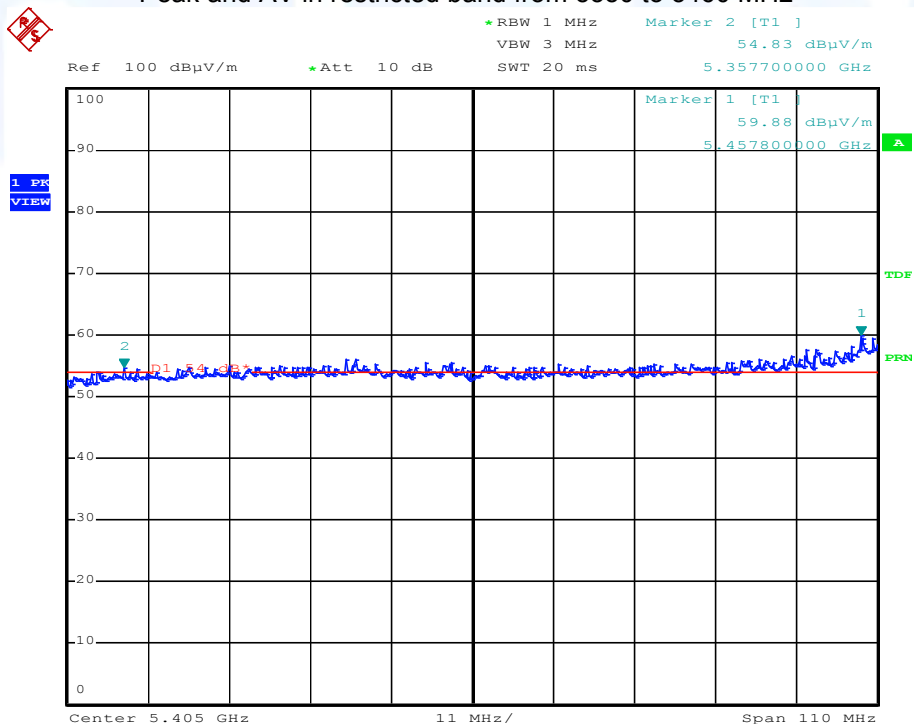
Ref -10 dBm *Att 0 dB *RBW 1 MHz Marker 1 [T1]
*VBW 1 MHz -61.50 dBm
SWT 240 ms 25.800000000 GHz



FCC:BV5SMALLENGINE 30 GHz – 40 GHz

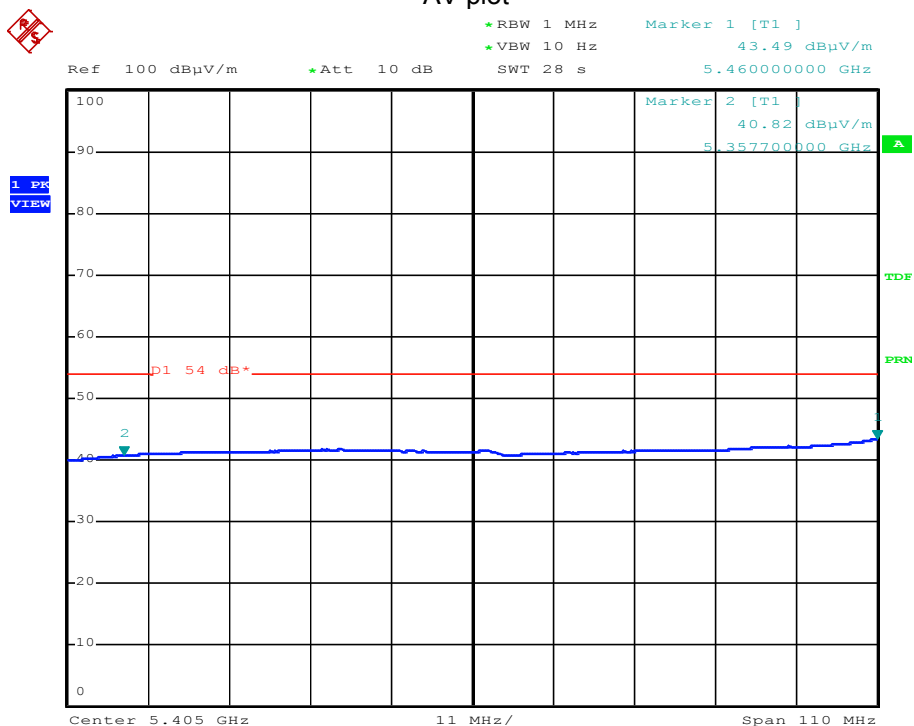


Peak and AV in restricted band from 5350 to 5460 MHz



FCC:BV5SMALLENGINE

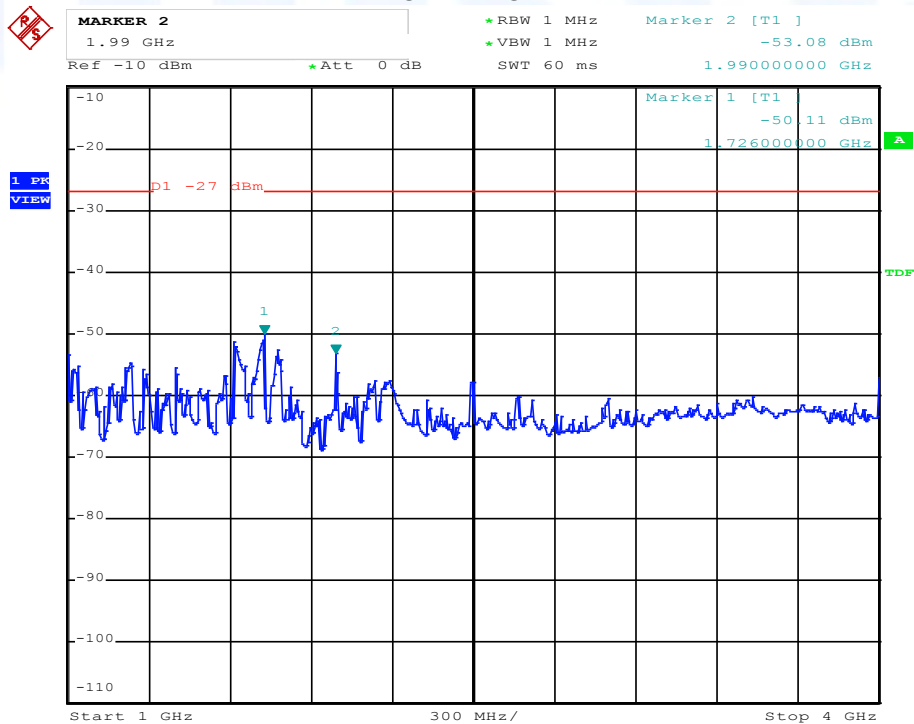
AV plot



Carrier frequency at channel 134 (5670 MHz)

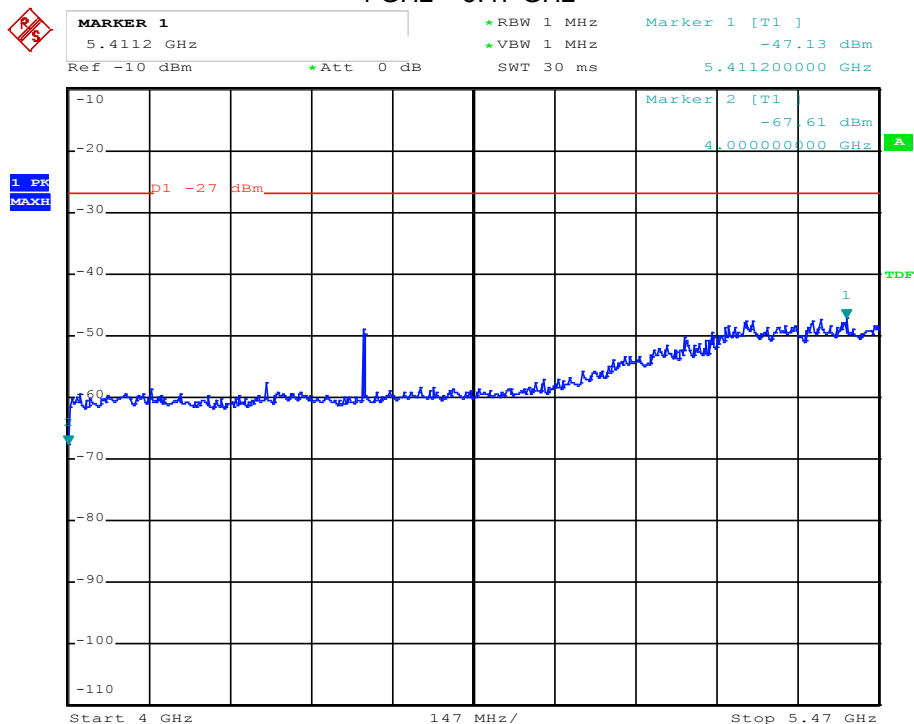
EUT settings: TXPOW0=2, TXPOW1=2, TXANT=0, TXMODE=3, TXMCS=8, TXBW=1, ATE=TXCONT

1 GHz – 4 GHz



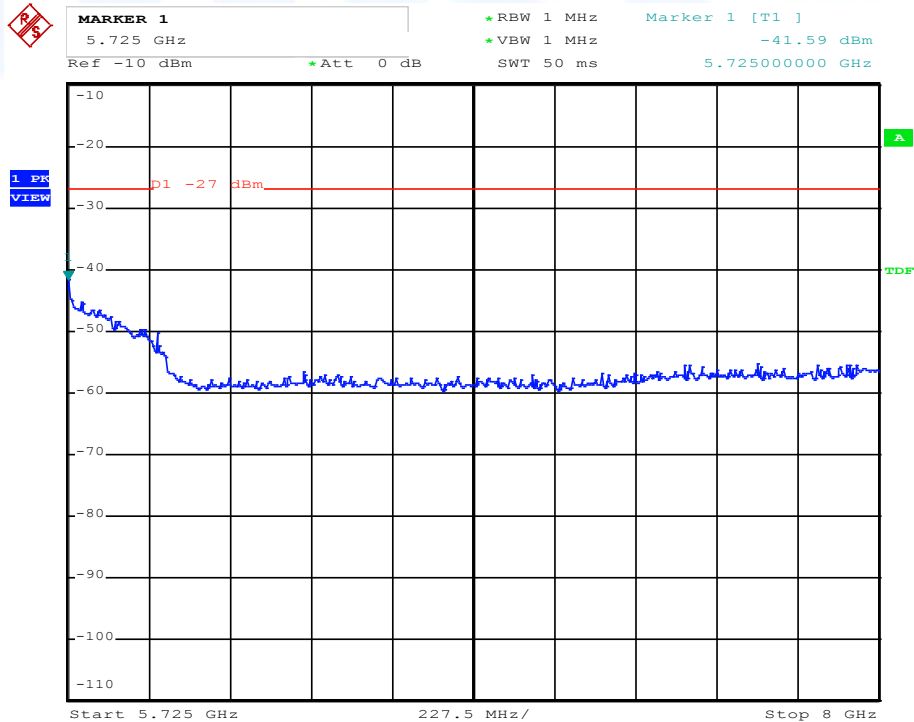
FCC:BV5SMALLENGINE

4 GHz – 5.47 GHz

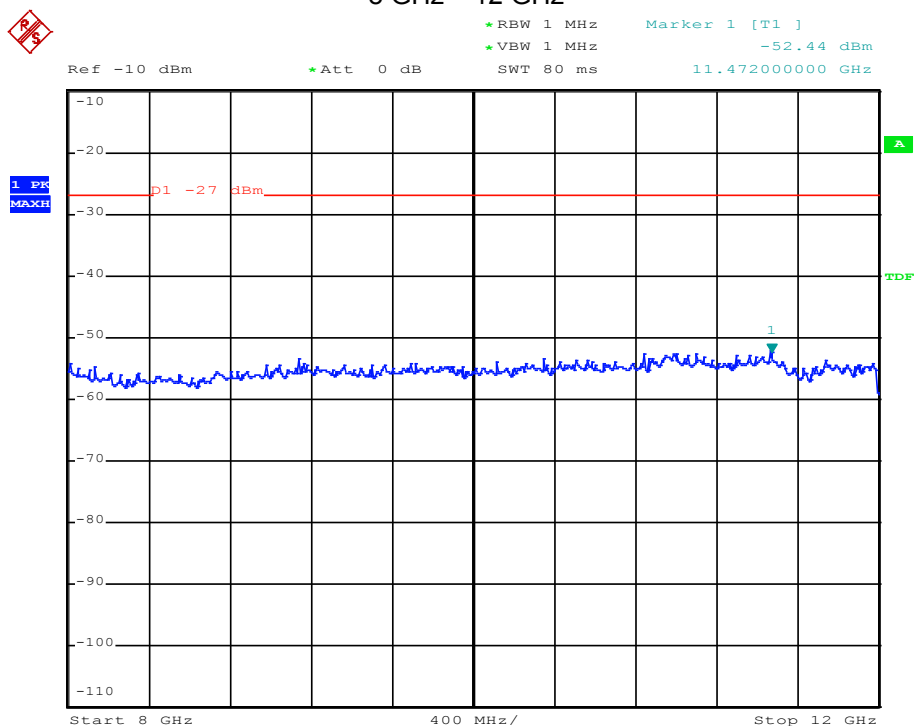


Estimation of the field strength in restricted bands using the transmission formula $FS = \sqrt{(EIRP \cdot 30)/D}$;
4536 MHz, -49.0 dBm → 55.1 dBμV/m; AV-limit exceeded → Re-measurement.

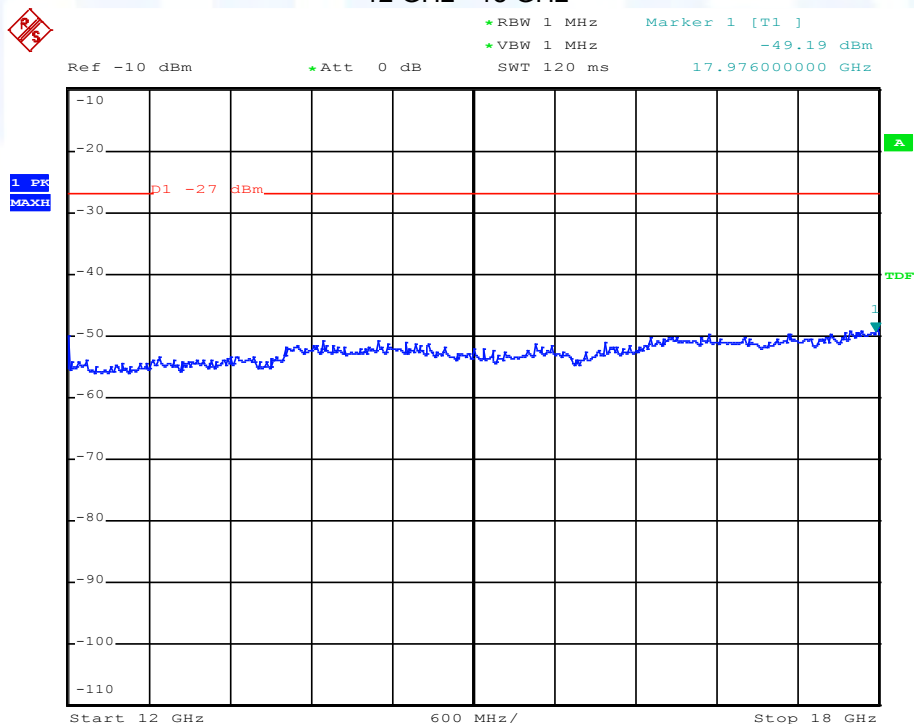
5.725 GHz – 8 GHz



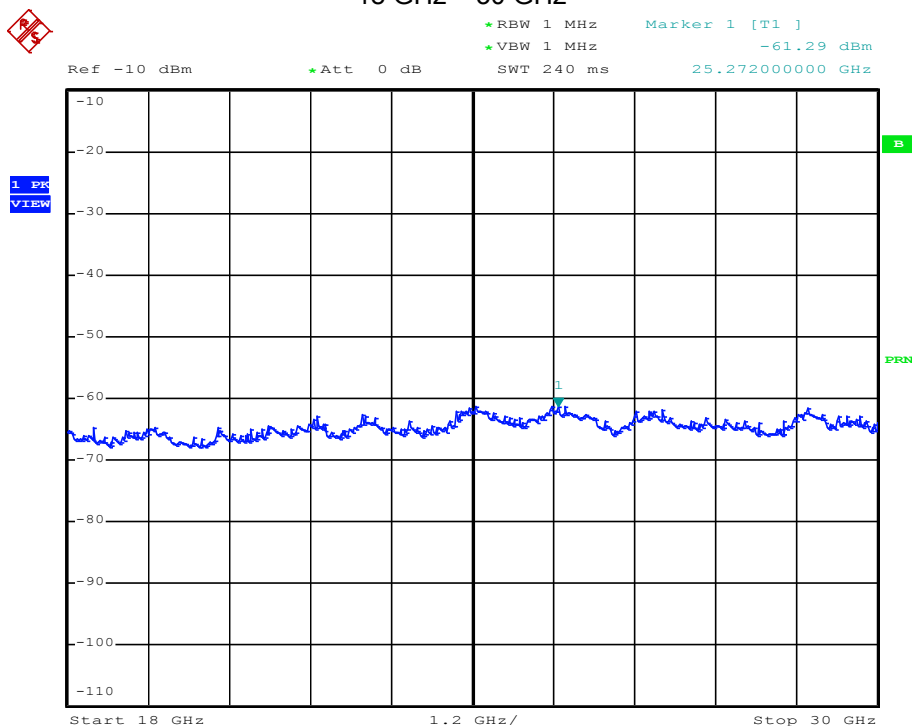
FCC:BV5SMALLENGINE 8 GHz – 12 GHz



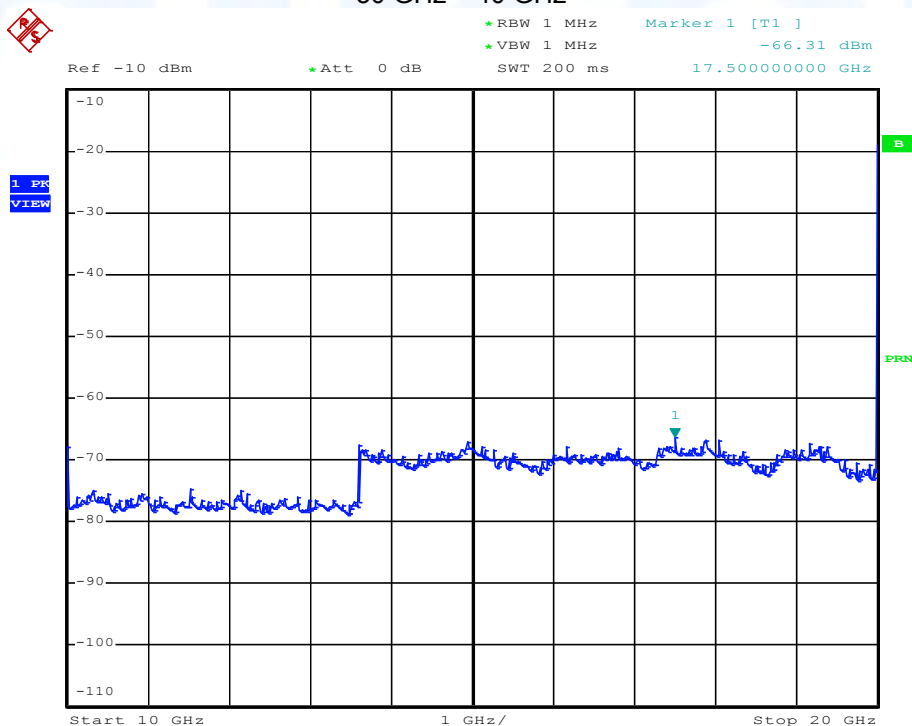
12 GHz - 18 GHz



FCC:BV5SMALLENGINE 18 GHz – 30 GHz



30 GHz – 40 GHz



FCC:BV5SMALLENGINE

Peak in restricted band from 5350 to 5460 MHz



MARKER 1

5.37574 GHz

Ref 97 dBµV/m

Att 0 dB

RBW 1 MHz

VBW 3 MHz

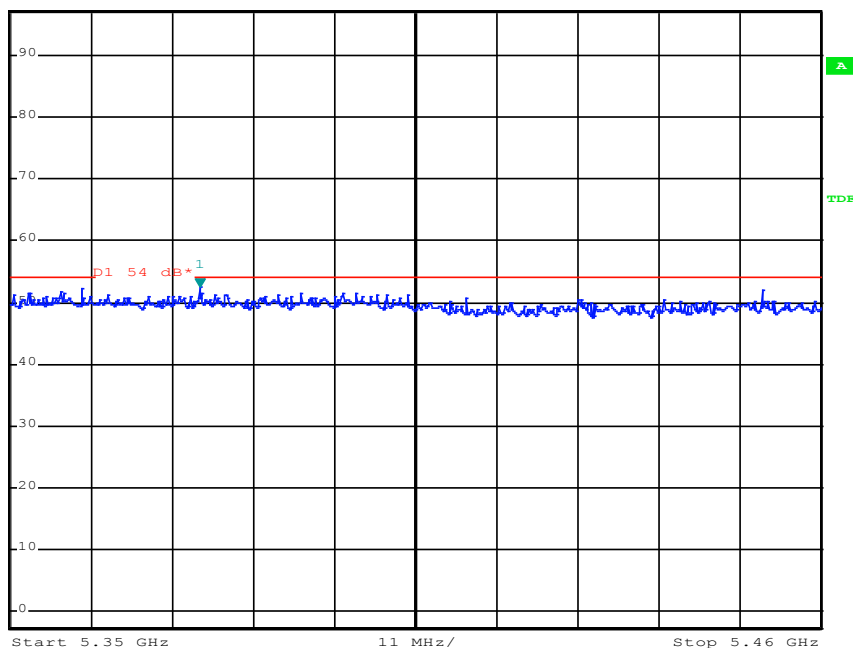
SWT 20 ms

Marker 1 [T1]

52.55 dBµV/m

5.375740000 GHz

1 PK
VIEW



FCC:BV5SMALLENGINE

5.7 Frequency stability

For test instruments and accessories used see section 6 Part **MB**.

5.7.1 Description of the test location

Test location: AREA 4

5.7.2 Photo documentation of the test setup**5.7.3 Applicable standard**

According to FCC Part 15, Subpart E, Section 15.407 (g):

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

5.7.4 Description of Measurement

This test have been performed over variations in temperature and voltage. The lowest and the highest channel in the operating frequency bands is measured at the 20 dB bandwidth under following conditions:

1. Supply voltage from 100 VAC to 120 VAC at normal temperature
2. Extreme temperature from 0 °C to 40 °C at nominal voltage.

FCC:BV5SMALLENGINE

5.7.5 Test result

Frequency band 5150 – 5250 MHz:

Worse case HT40 mode:

EUT settings: TXPOW0=3, TXPOW1=5, TXANT=0, TXMODE=3, TXMCS=15, TXBW=1, ATE=TXCONT

Test conditions		Test result	
		Frequency (MHz)	
T _{nom} (20°C)	V _{max}	f _L	5169.1435
		f _H	5248.5041
	V _{min}	f _L	5169.1437
		f _H	5248.5037
T _{max} (40°C)	V _{nom}	f _L	5170.1500
		f _H	5248.3425
T(30°C)	V _{nom}	f _L	5169.3400
		f _H	5248.3650
T(10°C)	V _{nom}	f _L	5169.1552
		f _H	5248.3612
T _{min} (0°C)	V _{nom}	f _L	5169.4130
		f _H	5248.5316
Measurement uncertainty			±1500 Hz

Occupied spectrum envelope:

Measured frequency nearest at the lowest band edge:

$f_L = 5169.1435$ MHz

Measured frequency nearest at the highest band edge:

$f_H = 5248.5316$ MHz

Frequency band 5250 – 5350 MHz:

Worse case HT40 mode:

EUT settings: TXPOW0=0, TXPOW1=2, TXANT=0, TXMODE=3, TXMCS=15, TXBW=1, ATE=TXCONT

Test conditions		Test result	
		Frequency (MHz)	
T _{nom} (20°C)	V _{max}	f _L	5250.1210
		f _H	5328.3581
	V _{min}	f _L	5250.1200
		f _H	5328.3587
T _{max} (40°C)	V _{nom}	f _L	5250.1550
		f _H	5330.7137
T(30°C)	V _{nom}	f _L	5251.6087
		f _H	5328.3606
T(10°C)	V _{nom}	f _L	5251.6075
		f _H	5330.7687
T _{min} (0°C)	V _{nom}	f _L	5250.8027
		f _H	5328.5213
Measurement uncertainty			±1500 Hz

Occupied spectrum envelope:

Measured frequency nearest at the lowest band edge:

$f_L = 5250.1200$ MHz

Measured frequency nearest at the highest band edge:

$f_H = 5330.7687$ MHz

FCC:BV5SMALLENGINE

Frequency band 5470 – 5725 MHz:

Worse case HT20 mode:

EUT settings: TXPOW0=2, TXPOW1=0, TXANT=0, TXMODE=3, TXMCS=7, TXBW=0, ATE=TXCONT

Test conditions		Test result	
		Frequency (MHz)	
T _{nom} (20°C)	V _{max}	f _L	5489.9693
		f _H	5710.1318
	V _{min}	f _L	5489.9687
		f _H	5710.1312
T _{max} (40°C)	V _{nom}	f _L	5490.9512
		f _H	5709.9562
T(30°C)	V _{nom}	f _L	5490.9475
		f _H	5710.0781
T(10°C)	V _{nom}	f _L	5490.9362
		f _H	5709.0432
T _{min} (0°C)	V _{nom}	f _L	5490.9413
		f _H	5709.0218
Measurement uncertainty			±1500 Hz

Occupied spectrum envelope:

Measured frequency nearest at the lowest band edge:

$f_L = 5489.9687$ MHz

Measured frequency nearest at the highest band edge:

$f_H = 5710.1318$ MHz

According to FCC Part 15, Subpart E, Section 15.407 (g):

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

Operating frequency range limit	
(MHz)	(MHz)
5150	5250
5250	5350
5470	5725

The requirements are **FULFILLED**.

Remarks:

FCC:BV5SMALLENGINE

5.8 Maximum permissible exposure (MPE)

For test instruments and accessories used see section 6 Part **CPC 3**.

5.8.1 Description of the test location

Test location: AREA 4

5.8.2 Photo documentation of the test set-up



5.8.3 Applicable standard

According to FCC Part 15, Section 15.407(f):

U-NII devices are subject to the radio frequency radiation exposure requirements specified in Section 1.1307(b), 2.1091 and 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. The test methods used comply with ANSI/IEEE C95.1-2005, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz".

5.8.4 Description of Measurement

The maximum total power input to the antenna has been measured and conducted as described in clause 5.3 of this document. Through the Friis transmission formula, which is a far field assumption and the known maximum gain of the antenna, the maximum MPE at a defined distance away from the product, can be calculated.

Friis transmission formula:

$$P_d = \frac{P_{out} * G}{4 * \pi * r^2}$$

where

- P_d = power density in mW/cm²
- P_{out} = output power to antenna in mW
- G = gain of antenna (linear scale)
- r = distance between antenna and observation point (cm)

FCC:BV5SMALLENGINE

5.8.5 Test result

For fixed equipment the distance $r = 20$ cm;

HT20, Ant1:

Channel No.	Frequency	Max power output to antenna		Antenna gain	Power density	Limit of power density
		(dBm)	(mW)			
	(MHz)			lin	(mW/cm ²)	(mW/cm ²)
36	5180	13.3	21.38	3.16	0.0060	1.0
40	5200	12.6	18.20	3.16	0.0051	1.0
48	5240	13.5	22.39	3.16	0.0063	1.0
52	5260	13.0	19.95	3.16	0.0056	1.0
56	5280	13.3	21.38	3.16	0.0060	1.0
64	5320	14.0	25.12	3.16	0.0071	1.0
100	5500	13.3	21.38	3.16	0.0060	1.0
120	5600	12.5	17.78	3.16	0.0050	1.0
140	5700	12.7	18.62	3.16	0.0052	1.0

HT20, Ant2:

Channel No.	Frequency	Max power output to antenna		Antenna gain	Power density	Limit of power density
		(dBm)	(mW)			
	(MHz)			lin	(mW/cm ²)	(mW/cm ²)
36	5180	13.6	22.91	3.16	0.0064	1.0
40	5200	13.3	21.38	3.16	0.0060	1.0
48	5240	13.7	23.44	3.16	0.0066	1.0
52	5260	13.5	22.39	3.16	0.0063	1.0
56	5280	14.0	25.12	3.16	0.0071	1.0
64	5320	12.9	19.50	3.16	0.0055	1.0
100	5500	15.1	32.36	3.16	0.0091	1.0
120	5600	15.0	31.62	3.16	0.0089	1.0
140	5700	12.7	18.62	3.16	0.0052	1.0

HT20, Ant1 + Ant2:

Channel No.	Frequency	Max power output to antenna		Antenna gain	Power density	Limit of power density
		(dBm)	(mW)			
	(MHz)			lin	(mW/cm ²)	(mW/cm ²)
36	5180	16.5	44.29	3.16	0.0124	1.0
40	5200	16.0	39.58	3.16	0.0111	1.0
48	5240	16.6	45.83	3.16	0.0129	1.0
52	5260	16.3	42.34	3.16	0.0119	1.0
56	5280	16.7	46.50	3.16	0.0131	1.0
64	5320	16.5	44.62	3.16	0.0125	1.0
100	5500	17.3	53.74	3.16	0.0151	1.0
120	5600	16.9	49.41	3.16	0.0139	1.0
140	5700	15.7	37.24	3.16	0.0105	1.0

Note: This is the mathematical summed power density of Ant1 and Ant2.

FCC:BV5SMALLENGINE

HT40, Ant1:

Channel No.	Frequency	Max power output to antenna		Antenna gain	Power density	Limit of power density
		(dBm)	(mW)			
	(MHz)			lin	(mW/cm ²)	(mW/cm ²)
38	5190	13.5	22.39	3.16	0.0063	1.0
46	5230	13.2	20.89	3.16	0.0059	1.0
54	5270	13.1	20.42	3.16	0.0057	1.0
62	5310	12.8	19.05	3.16	0.0054	1.0
102	5510	13.0	19.95	3.16	0.0056	1.0
110	5550	12.6	18.20	3.16	0.0051	1.0
134	5670	13.0	19.95	3.16	0.0056	1.0

HT40, Ant2:

Channel No.	Frequency	Max power output to antenna		Antenna gain	Power density	Limit of power density
		(dBm)	(mW)			
	(MHz)			lin	(mW/cm ²)	(mW/cm ²)
38	5190	12.6	18.20	3.16	0.0051	1.0
46	5230	12.1	16.22	3.16	0.0046	1.0
54	5270	12.5	17.78	3.16	0.0050	1.0
62	5310	13.2	20.89	3.16	0.0059	1.0
102	5510	12.5	17.78	3.16	0.0050	1.0
110	5550	12.7	18.62	3.16	0.0052	1.0
134	5670	12.9	19.50	3.16	0.0055	1.0

HT40, Ant1 + Ant2:

Channel No.	Frequency	Max power output to antenna		Antenna gain	Power density	Limit of power density
		(dBm)	(mW)			
	(MHz)			lin	(mW/cm ²)	(mW/cm ²)
38	5190	16.1	40.58	3.16	0.0114	1.0
46	5230	15.7	37.11	3.16	0.0104	1.0
54	5270	15.8	38.20	3.16	0.0107	1.0
62	5310	16.0	39.95	3.16	0.0112	1.0
102	5510	15.8	37.74	3.16	0.0106	1.0
110	5550	15.7	36.82	3.16	0.0103	1.0
134	5670	16.0	39.45	3.16	0.0111	1.0

Note: This is the mathematical summed power density of Ant1 and Ant2.

802.11a, Ant1:

Channel No.	Frequency	Max power output to antenna		Antenna gain	Power density	Limit of power density
		(dBm)	(mW)			
	(MHz)			lin	(mW/cm ²)	(mW/cm ²)
36	5180	13.3	21.38	3.16	0.0060	1.0
40	5200	13.1	20.42	3.16	0.0057	1.0
48	5240	13.7	23.44	3.16	0.0066	1.0
52	5260	12.7	18.62	3.16	0.0052	1.0
56	5280	12.9	19.50	3.16	0.0055	1.0
64	5320	13.7	23.44	3.16	0.0066	1.0
100	5500	13.3	21.38	3.16	0.0060	1.0
120	5600	12.5	17.78	3.16	0.0050	1.0
140	5700	12.3	16.98	3.16	0.0048	1.0

FCC:BV5SMALLENGINE

Limits for maximum permissible exposure (MPE):

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(B) Limits for General Population / Uncontrolled Exposure				
0.3 – 3.0	614	1.63	100	30
3.0 – 30	824/f	2.19/f	180/ f ²	30
30 - 300	27.5	0.073	0.2	30
300-1500	---	---	f/1500	30
1500-100000	---	---	1.0	30

f = Frequency (MHz)

The requirements are **FULFILLED**.

Remarks: This test report shows the compliance with the limits for maximum permissible exposure (MPE)
specified in FCC 1.1310 and the criteria to evaluate the environmental impact of human exposure
to radio-frequency (RF) radiation as specified in FCC 1.1307(b).

FCC:BV5SMALLENGINE

5.9 Co-location and Co-transmission**Applicable standard:**

OET Bulletin 65, Edition 97-01, Section 2: Multiple-transmitter sites and complex environments

The MPE limits of FCC vary with frequency. Therefore, in mixed or broadband RF fields where several sources and frequencies are involved, the fraction of the recommended limit (in terms of power density or square of the electric or magnetic field strength) incurred within each frequency interval should be determined, and the sum of all fractional contributions should not exceed 1.0, or 100 % in terms of percentage.

There is no co-location issue the EUT provides with 2 TX streams simultaneously and use MIMO technique which is taken always into consideration.

The requirements are **FULFILLED**.

Remarks: For detailed test results please refer to following test protocols.

5.10 Antenna application - Detailed photos see attachment A**5.10.1 Applicable standard**

According to FCC Part 15C, Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT is used with the Antenna ASSY PN: 1551359 for MIMO technique. The antenna is an integrated antenna and is not designed for a change by user.

5.10.2 Antenna requirements

According to FCC Part 15E, Section 15.407(a):

The conducted output power limit specified in paragraph (a) of 15.407 is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from intentional radiator shall be reduced below the stated values in paragraph (a)(1), (a)(2) and (a)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds the effective value.

The EUT use the antenna ASSY PN: 1551359 for MIMO technique. The antenna gain is 5.0 dBi. No output power reduction results.

FCC:BV5SMALLENGINE

5.11 Receiver spurious emissions, radiated

For test instruments and accessories used see section 6 Part **SER 2** and **SER 3**.

5.11.1 Description of the test location

Test location: Anechoic Chamber A2
Test location: OATS 1
Test distance: 3 metres

5.11.2 Photo documentation of the test set-up

Anechoic chamber (Test setup for field strength measurement)



Open area test site (Test setup for 30 MHz – 1000 MHz)



FCC:BV5SMALLENGINE

5.11.3 Applicable standard

According to RSS-Gen, Section 6.1:

Receivers shall comply with the limits of spurious emissions set out in this section, measured over the frequency range determined in accordance with Section 4.10.

5.11.4 Description of Measurement

Radiated emissions from the EUT in the range $f < 1$ GHz are measured under the circumstances described in point 4.4. In the frequency range of 1 GHz to maximum frequency as specified in section RSS Gen 4.10. For testing above 1 GHz, the emission level of the EUT in peak mode complies with the average limit then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured again in average mode and reported.

5.11.5 Test result

$f < 1$ GHz

The emission < 1 GHz is independent of the channel setting, therefore the table for channel 36 only.

Ant1 + Ant2 + Ant3

Frequency (MHz)	L: QP (dB μ V)	Bandwidth (kHz)	Correction (dB/m)	L: QP (dB μ V/m)	Limit (dB μ V/m)	Delta
200	25,5	120	12,9	38,4	43,5	-5,1
400	21,9	120	19,1	41,0	46,0	-5,0
600	10,7	120	23,8	34,5	46,0	-11,5

FCC:BV5SMALLENGINE

f > 1 GHz

HT20, Ant1 + Ant2 + Ant3:

Frequency band: 5.15 GHz to 5.35 GHz

CH36			CH64		
f (MHz)	Level (dBμV/m)	Limit (dBμV/m)	f (MHz)	Level (dBμV/m)	Limit (dBμV/m)
-	-	54.0	-	-	54.0
Measurement uncertainty			± 6 dB		

Frequency band: 5.470 GHz to 5.725 GHz

CH100			CH140		
f (MHz)	Level (dBμV/m)	Limit (dBμV/m)	f (MHz)	Level (dBμV/m)	Limit (dBμV/m)
-	-	54.0	-	-	54.0
Measurement uncertainty			± 6 dB		

HT40, Ant1 + Ant2 + Ant3:

Frequency band: 5.15 GHz to 5.35 GHz

CH38			CH62		
f (MHz)	Level (dBμV/m)	Limit (dBμV/m)	f (MHz)	Level (dBμV/m)	Limit (dBμV/m)
-	-	54.0	-	-	54.0
Measurement uncertainty			± 6 dB		

Frequency band: 5.470 GHz to 5.725 GHz

CH102			CH134		
f (MHz)	Level (dBμV/m)	Limit (dBμV/m)	f (MHz)	Level (dBμV/m)	Limit (dBμV/m)
-	-	54.0	-	-	54.0
Measurement uncertainty			± 6 dB		

No peak emission could be detected that exceeds the AV limit.

Limit according to RSS-Gen, Table 2:

Frequency (MHz)	Limit (μV/m)	Limit (dBμV/m)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

The requirements are **FULFILLED**.

Remarks:

During the test, the EUT was set into continuous receiving mode. The measurement was performed up to the 3rd harmonic (18000 MHz). For detailed test results please see the following test protocols.

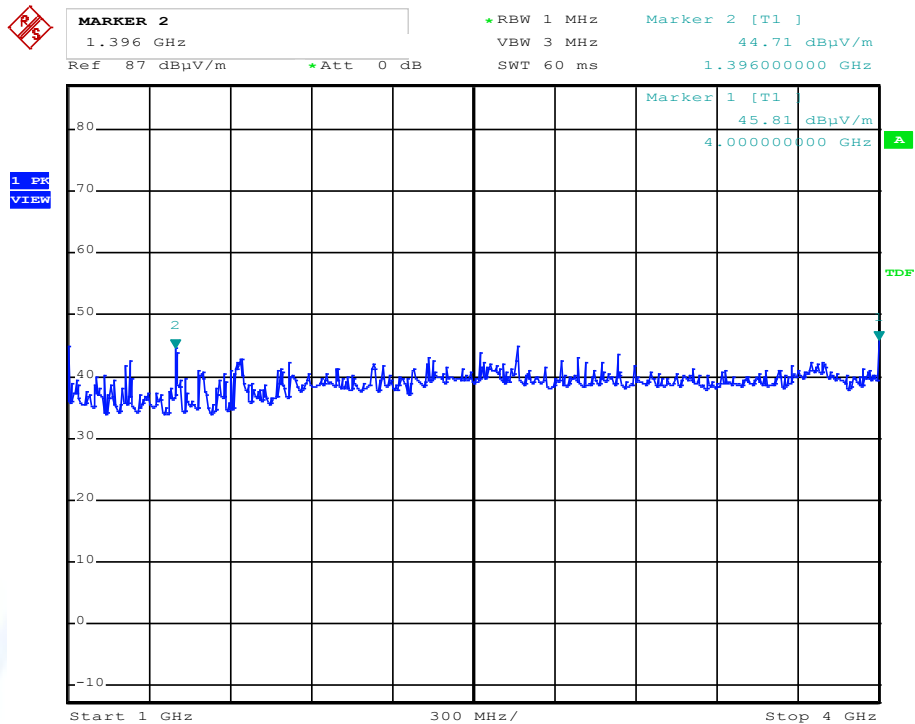
FCC:BV5SMALLENGINE

5.11.6 Test protocols receiver spurious emissions

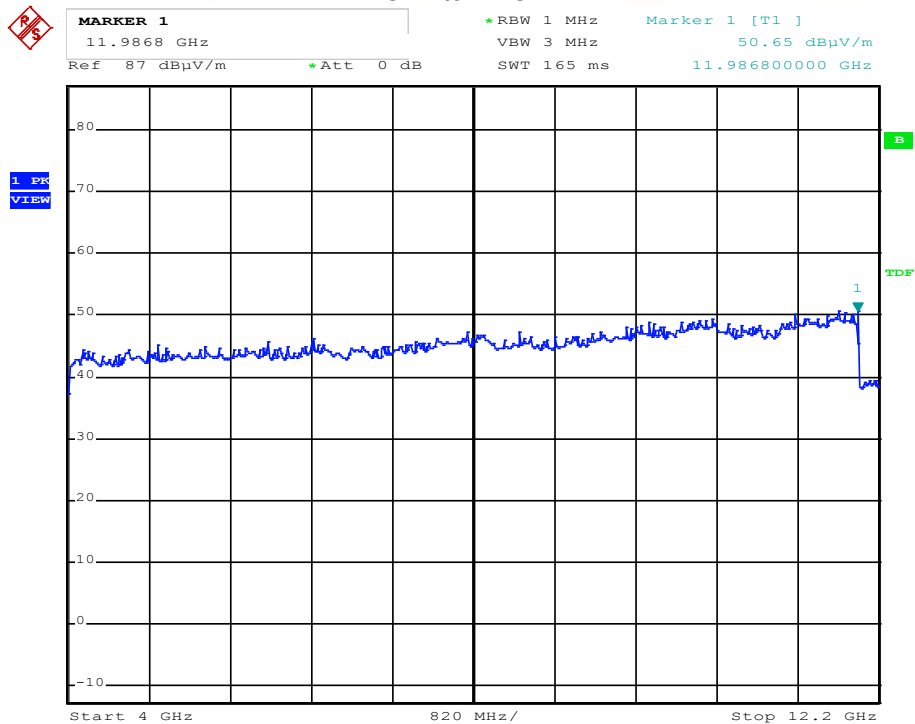
HT20:

Channel 36:

1 GHz to 4 GHz

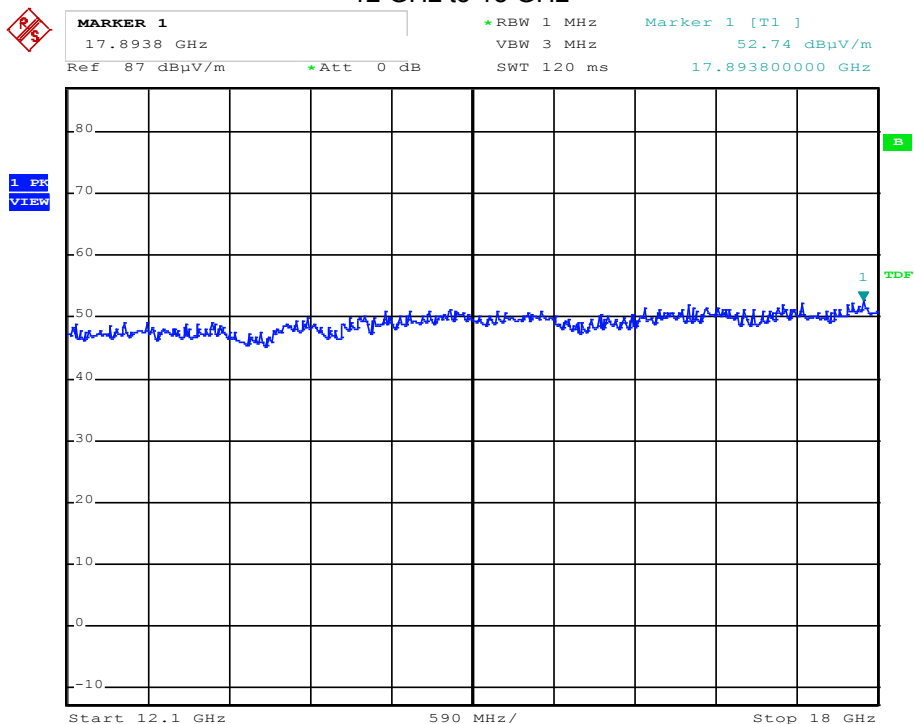


4 GHz to 12 GHz



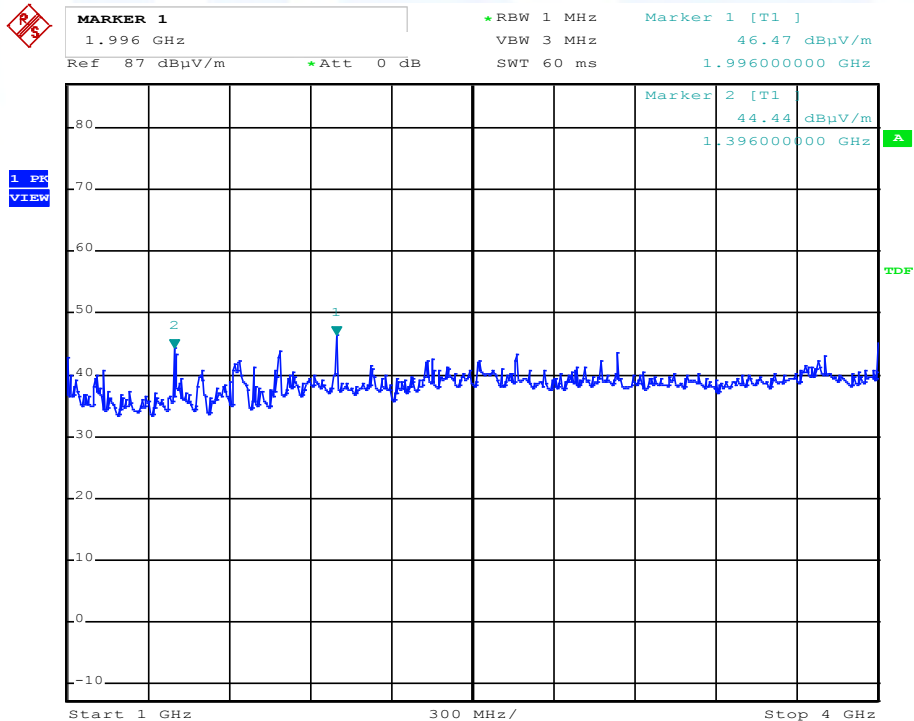
FCC:BV5SMALLENGINE

12 GHz to 18 GHz



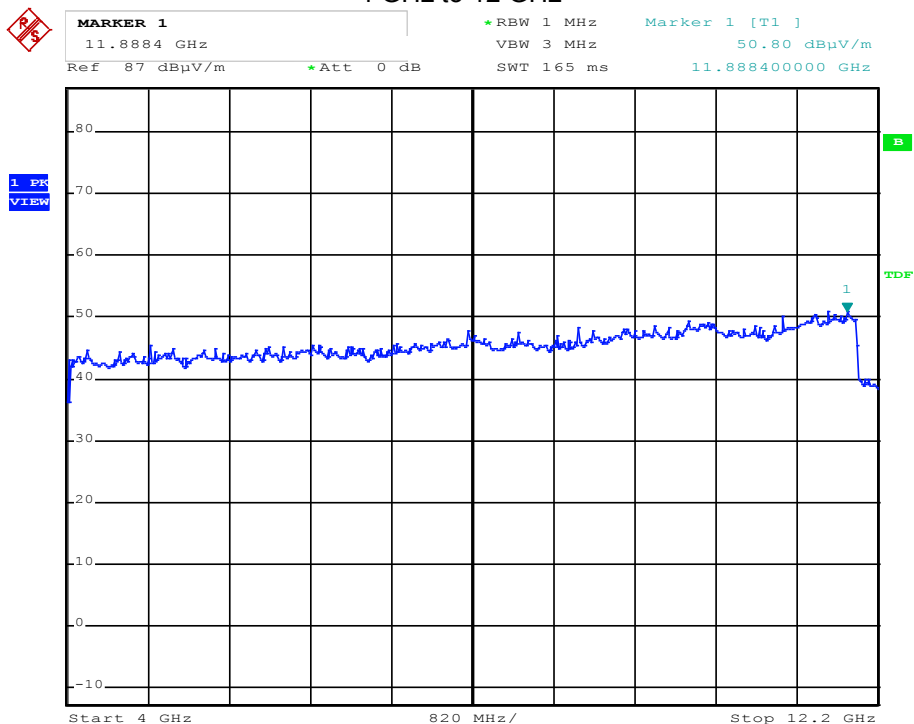
Channel 64:

1 GHz to 4 GHz

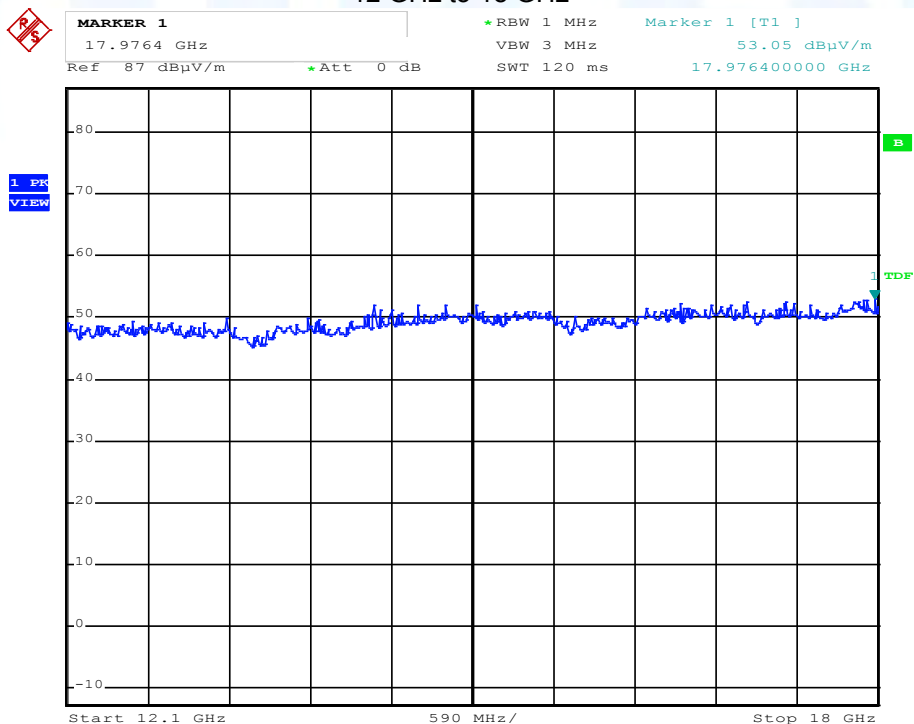


FCC:BV5SMALLENGINE

4 GHz to 12 GHz



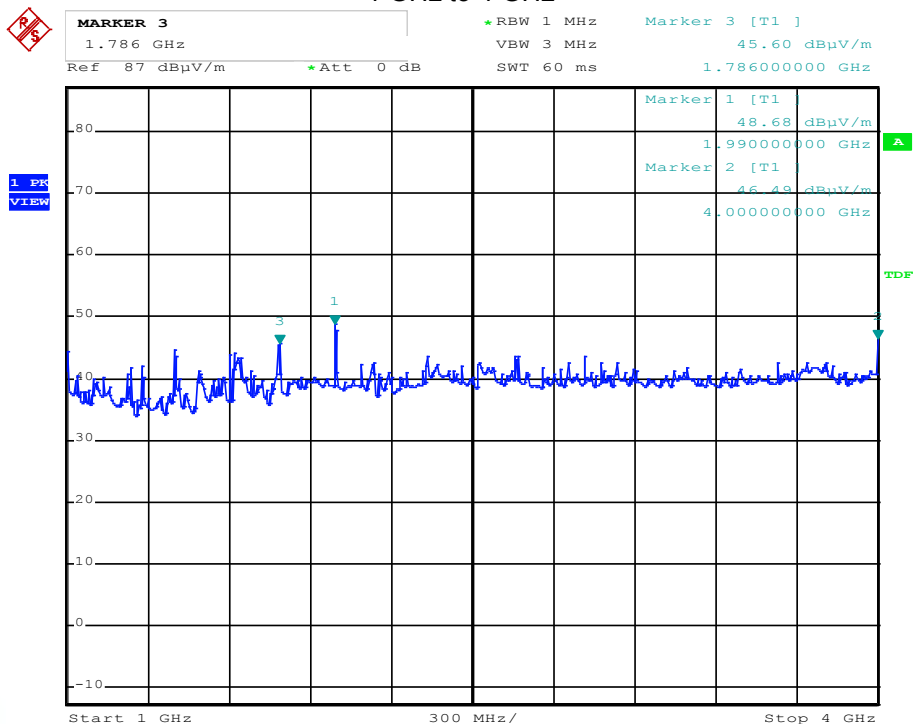
12 GHz to 18 GHz



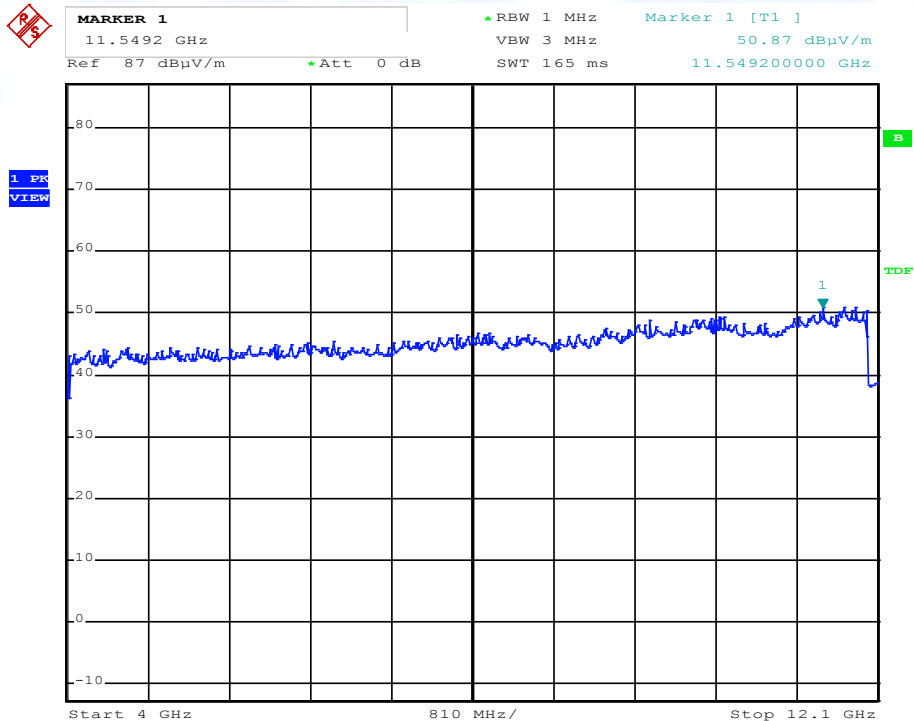
Channel 100:

FCC:BV5SMALLENGINE

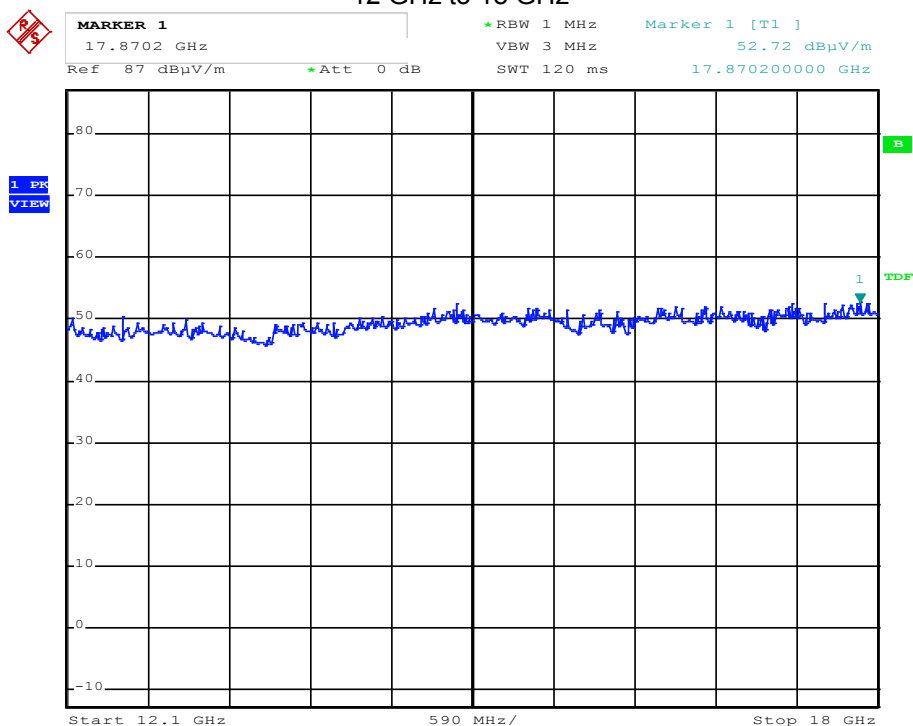
1 GHz to 4 GHz



4 GHz to 12 GHz

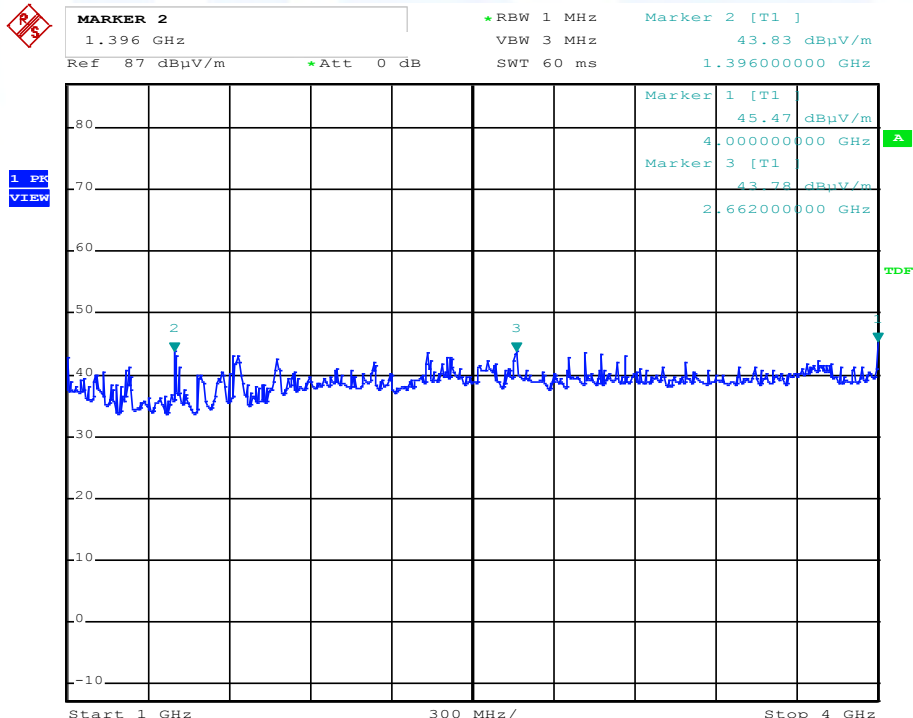


FCC:BV5SMALLENGINE 12 GHz to 18 GHz



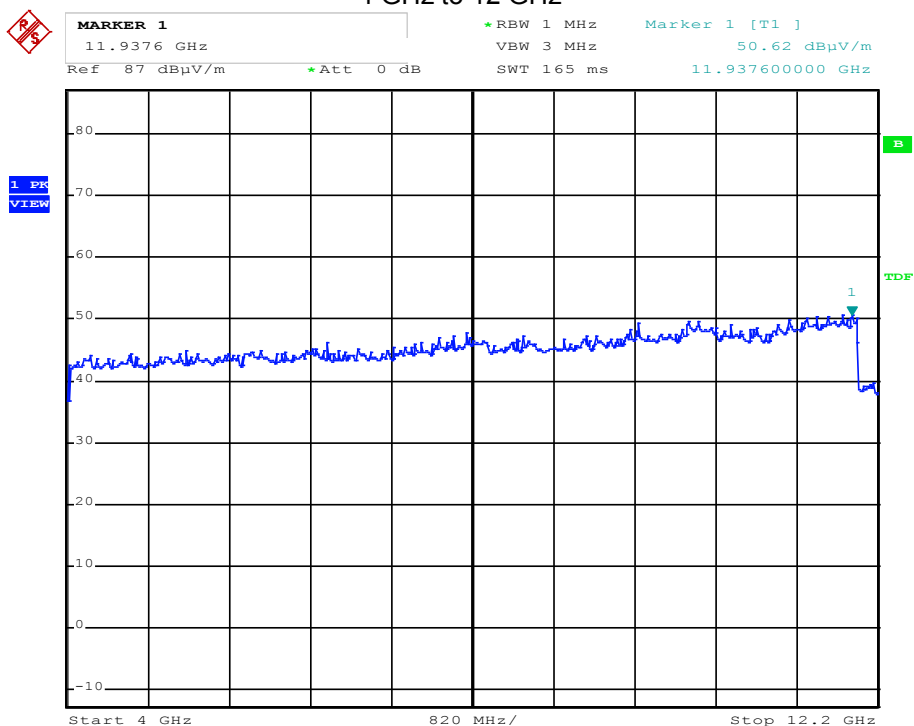
Channel 140:

1 GHz to 4 GHz

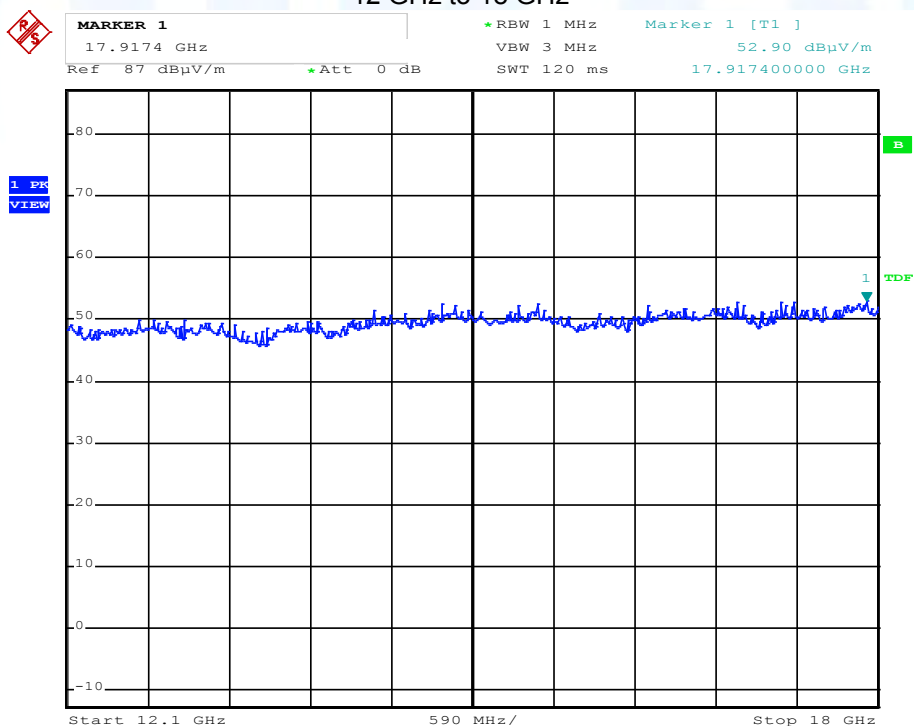


FCC:BV5SMALLENGINE

4 GHz to 12 GHz



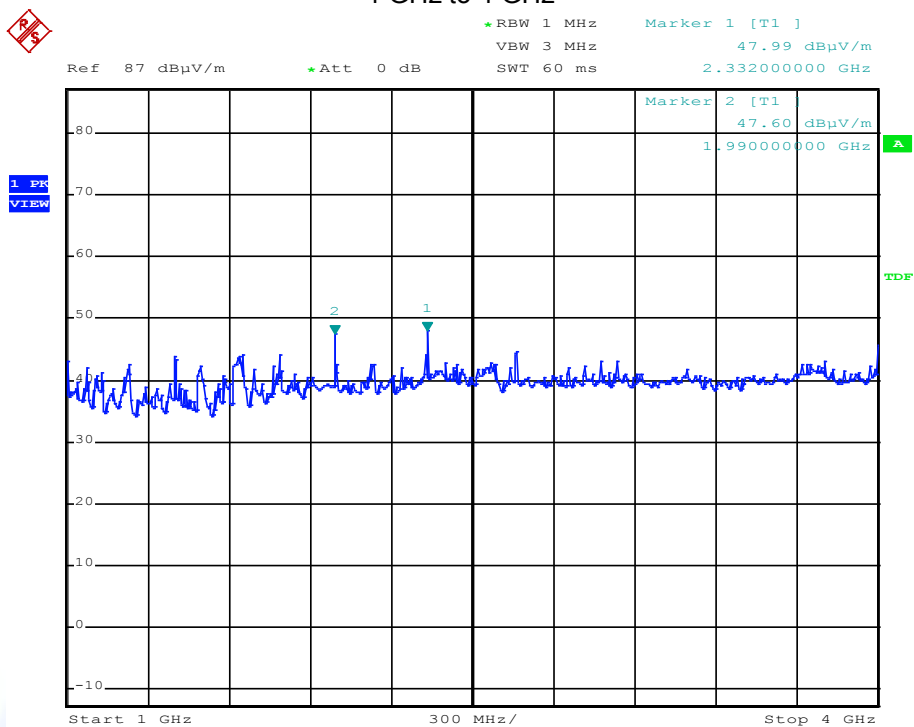
12 GHz to 18 GHz



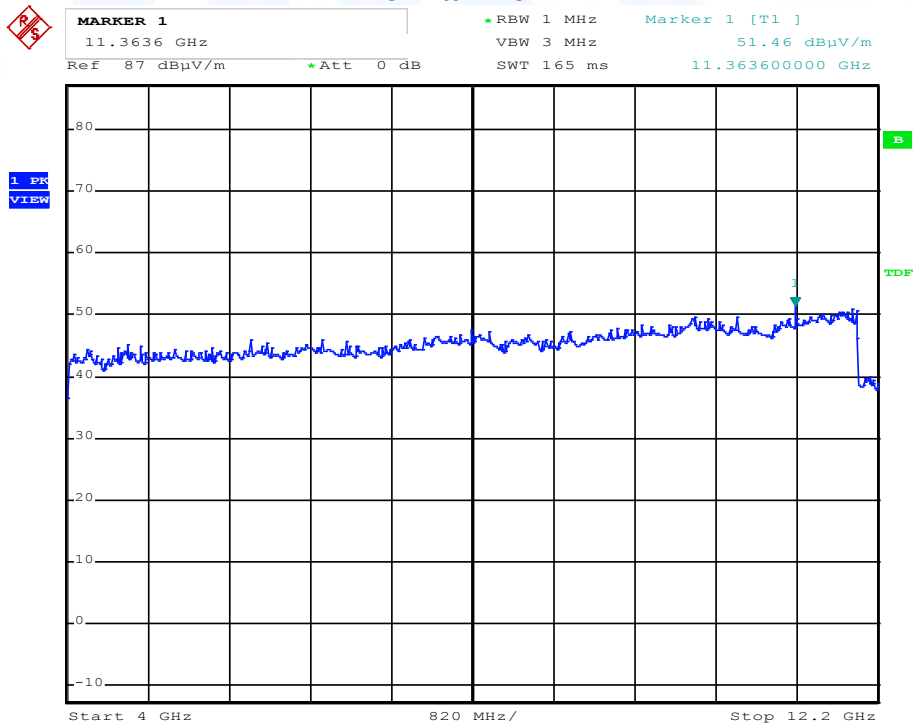
FCC:BV5SMALLENGINE

HT40:
Channel 38:

1 GHz to 4 GHz



4 GHz to 12 GHz



FCC:BV5SMALLENGINE

12 GHz to 18 GHz



MARKER 1

17.941 GHz

Ref 87 dBuV/m

*Att 0 dB

*RBW 1 MHz

VBW 3 MHz

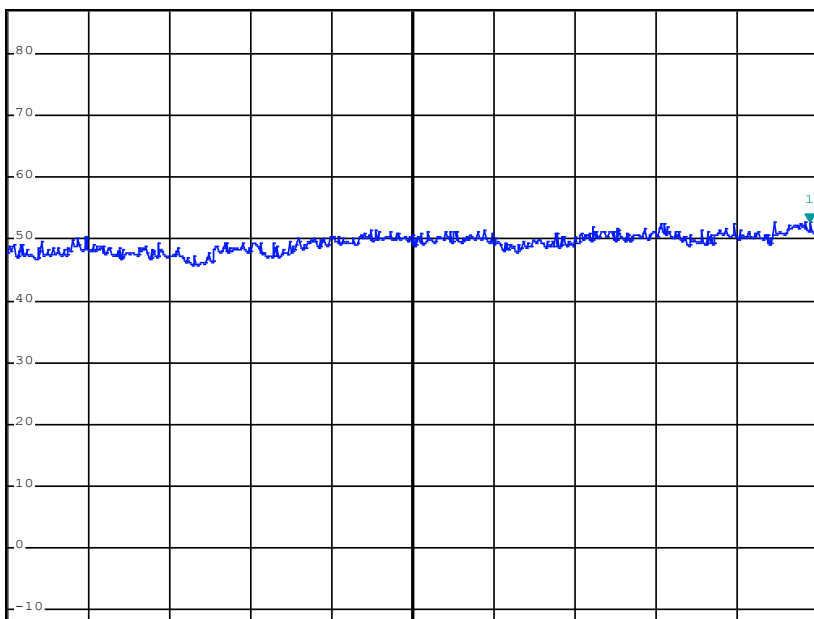
SWT 120 ms

Marker 1 [T1]

52.84 dBuV/m

17.941000000 GHz

1 PK
VIEW



Start 12.1 GHz

590 MHz/

Stop 18 GHz

Channel 62:

1 GHz to 4 GHz



Ref 87 dBuV/m

*Att 0 dB

*RBW 1 MHz

VBW 3 MHz

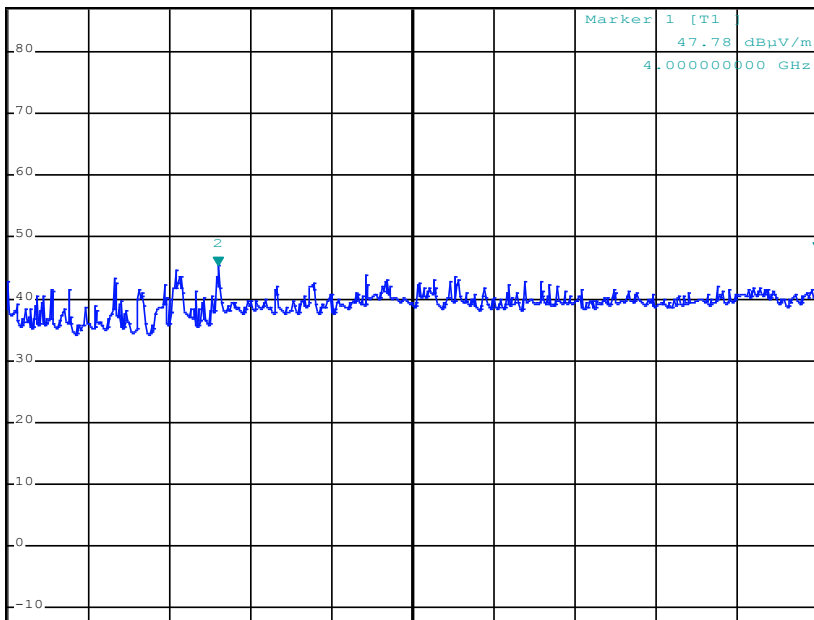
SWT 60 ms

Marker 2 [T1]

45.28 dBuV/m

1.780000000 GHz

1 PK
VIEW



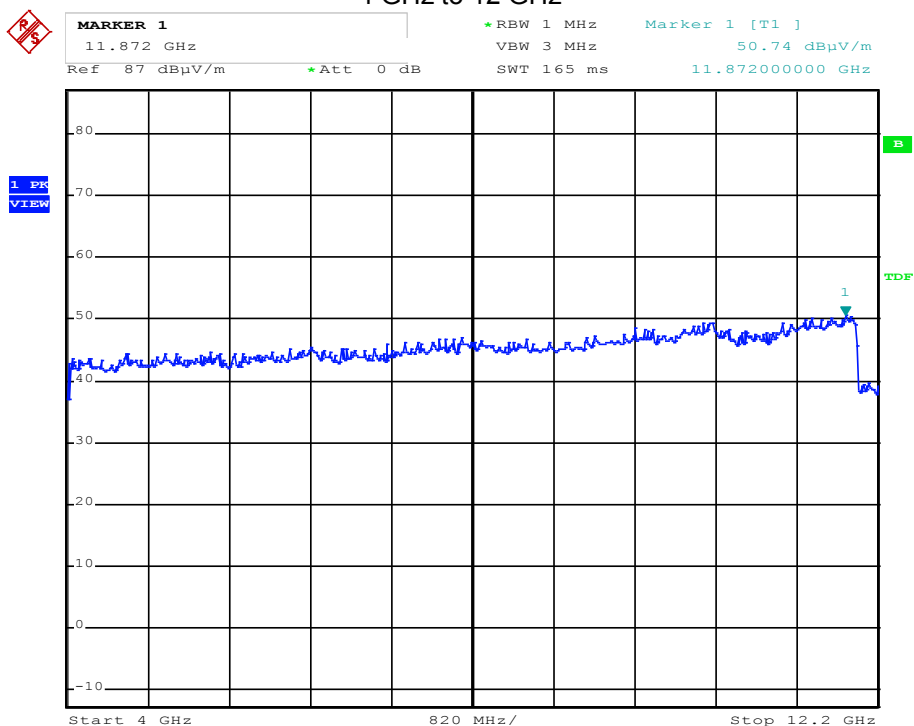
Start 1 GHz

300 MHz/

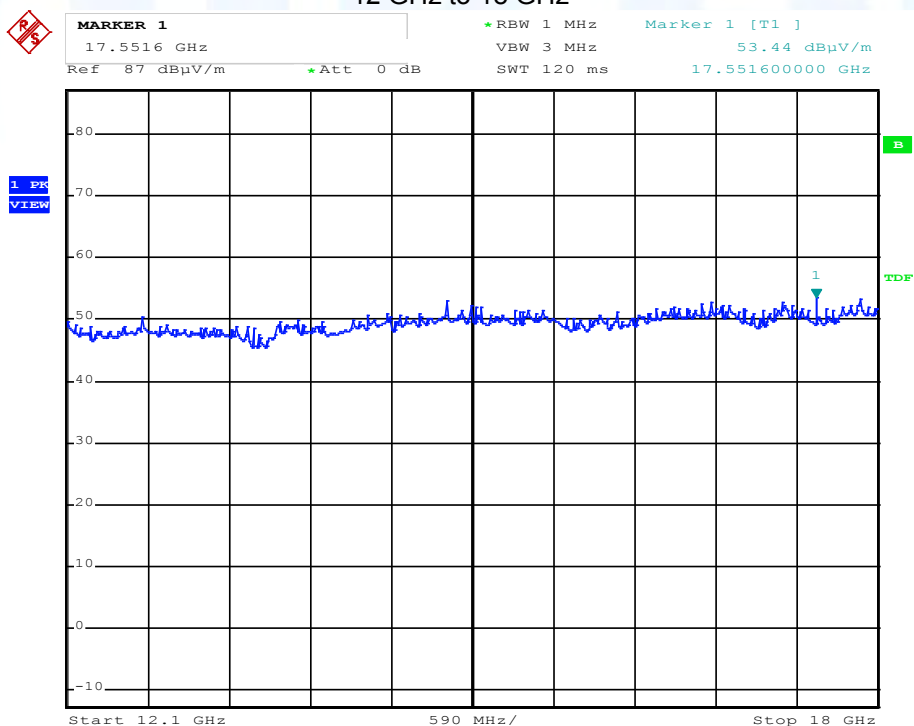
Stop 4 GHz

FCC:BV5SMALLENGINE

4 GHz to 12 GHz



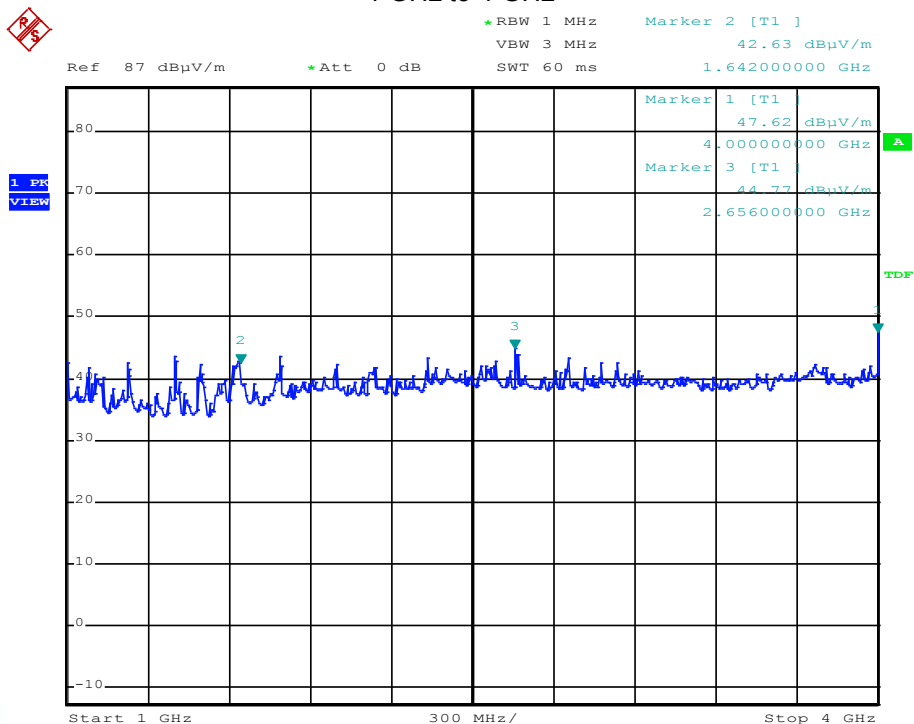
12 GHz to 18 GHz



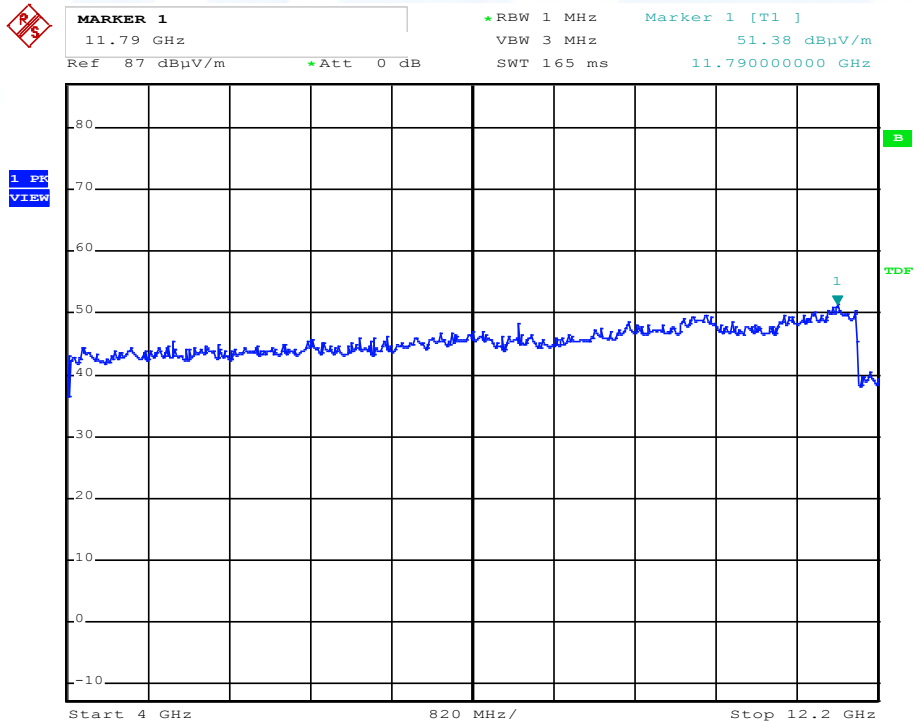
Channel 102:

FCC:BV5SMALLENGINE

1 GHz to 4 GHz

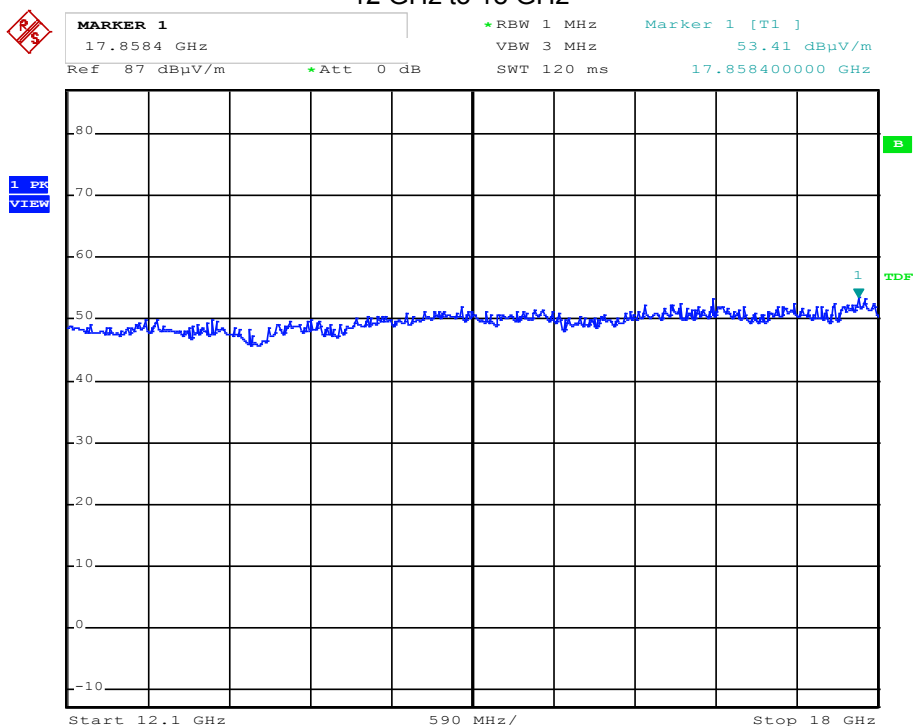


4 GHz to 12 GHz



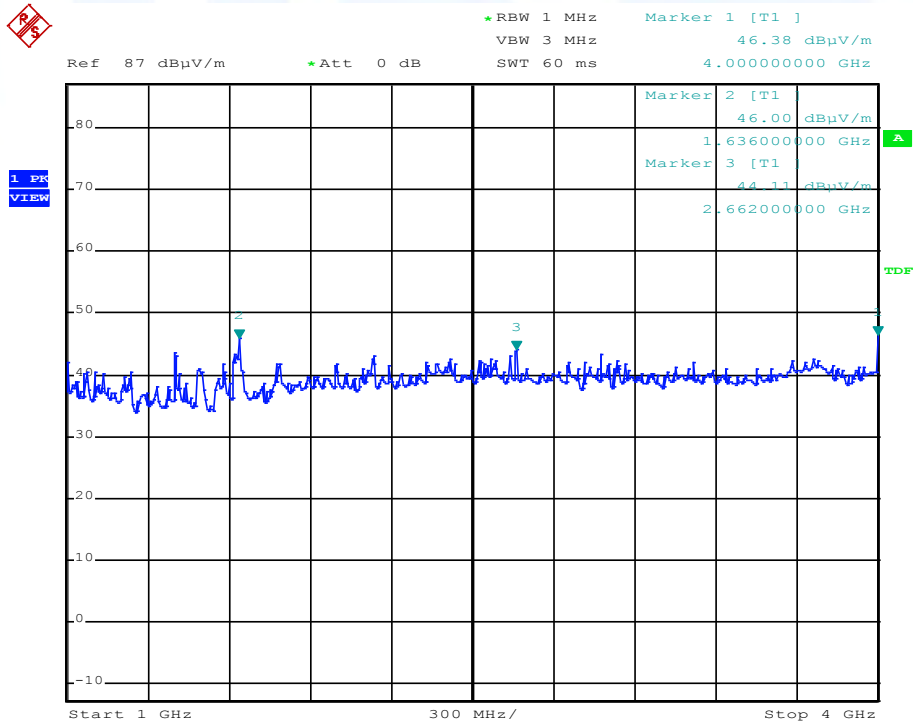
FCC:BV5SMALLENGINE

12 GHz to 18 GHz



Channel 134:

1 GHz to 4 GHz



FCC:BV5SMALLENGINE

4 GHz to 12 GHz



MARKER 1

11.8064 GHz

*RBW 1 MHz

Marker 1 [T1]

VBW 3 MHz

50.58 dBuV/m

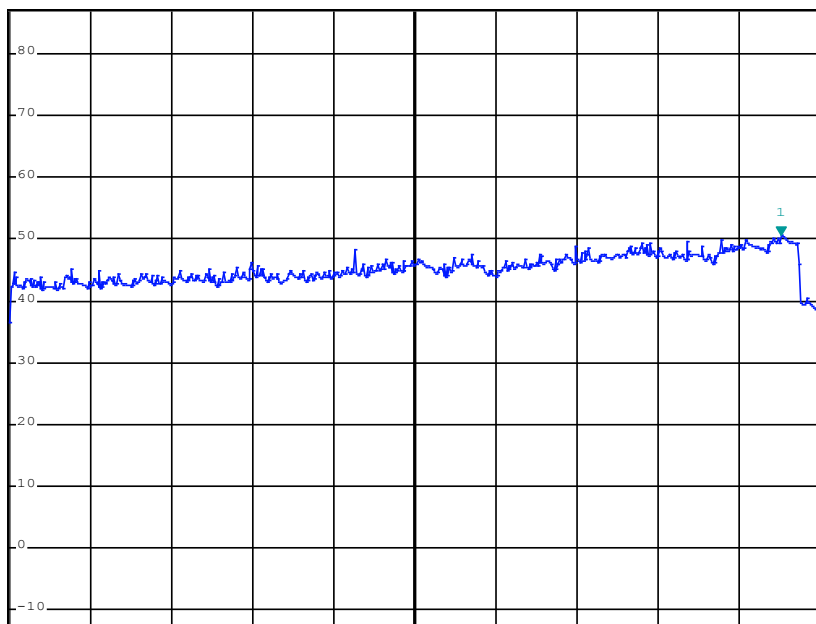
Ref 87 dBuV/m

*Att 0 dB

SWT 165 ms

11.806400000 GHz

1 PK
VIEW



Start 4 GHz

820 MHz/

Stop 12.2 GHz

12 GHz to 18 GHz



MARKER 1

17.7876 GHz

*RBW 1 MHz

Marker 1 [T1]

VBW 3 MHz

52.85 dBuV/m

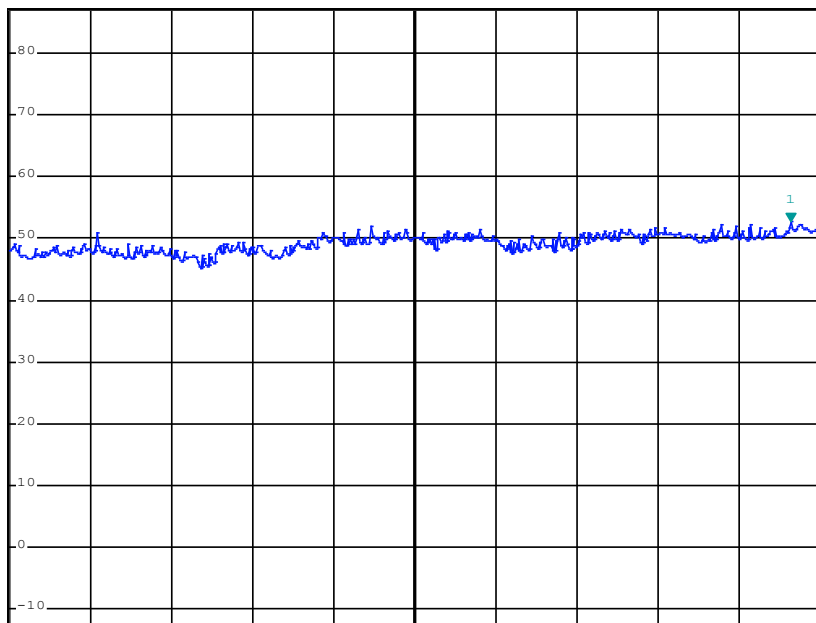
Ref 87 dBuV/m

*Att 0 dB

SWT 120 ms

17.787600000 GHz

1 PK
VIEW



Start 12.1 GHz

590 MHz/

Stop 18 GHz

FCC:BV5SMALLENGINE

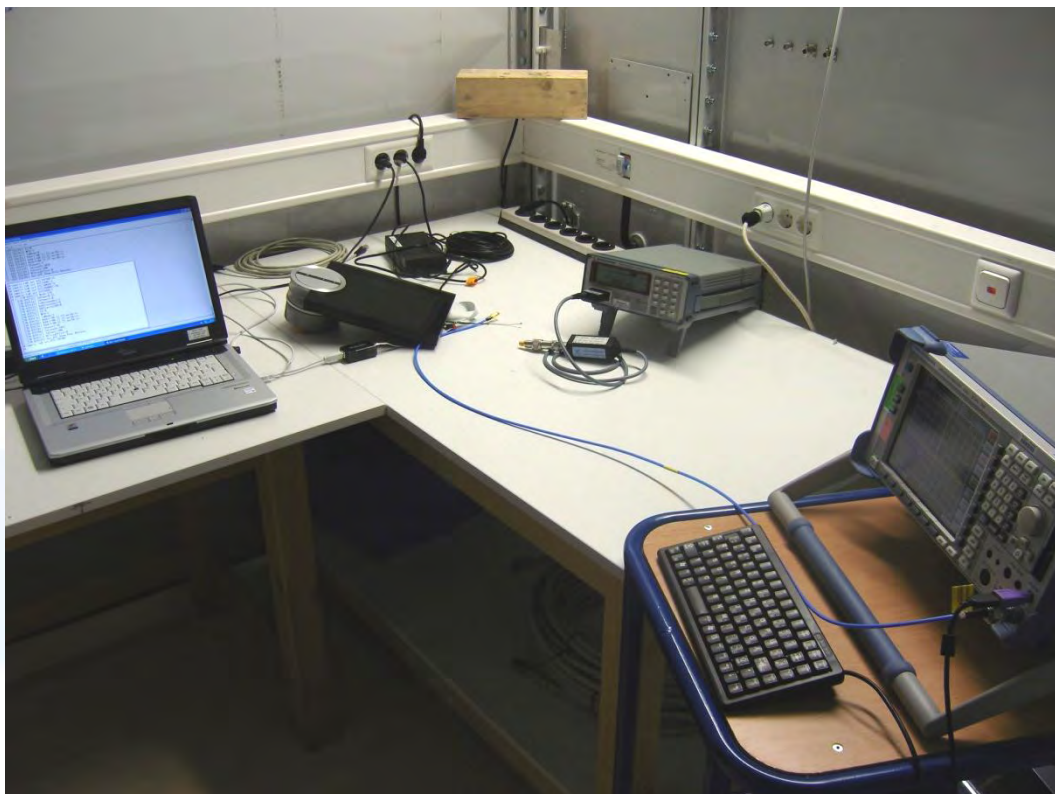
5.12 99% bandwidth

For test instruments and accessories used see section 6 Part MB.

5.12.1 Description of the test location

Test location: AREA 4

5.12.2 Photo documentation of the test set-up



5.12.3 Applicable standard

According to RSS-Gen Issue 2, 4.6.1:

When an occupied bandwidth is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth.

5.12.4 Description of Measurement

The bandwidth was measured with the function "bandwidth measurement" of the spectrum analyser. The EUT is connected via suitable attenuator at the spectrum analyser. The measurement is repeated for every different modulation standard of the EUT and recorded.

Spectrum analyzer settings:

RBW 1% of the selected span
Detector Peak

VBW 3 times RBW
Trace: No max hold

FCC:BV5SMALLENGINE

5.12.5 Test result

HT20 mode:

Spectrum analyzer settings: RBW: 1 MHz VBW: 3 MHz Detector: Peak

Channel number	Center frequency (MHz)	99% bandwidth (MHz)
36	5180	18.16
48	5240	18.16
64	5320	18.32
100	5500	18.32
116	5580	18.32
140	5700	18.16

HT20 mode:

Channel number	Center frequency (MHz)	99% bandwidth (MHz)
36	5180	17.60
48	5240	17.52
64	5320	17.60
100	5500	17.60
116	5580	17.68
140	5700	17.60

HT40 mode:

Spectrum analyzer settings: RBW: 1 MHz VBW: 3 MHz Detector: Peak

Channel number	Center frequency (MHz)	99% bandwidth (MHz)
38	5190	36.32
46	5230	37.76
62	5310	36.32
102	5510	37.60
110	5550	36.32
134	5670	36.64

HT40 mode:

Channel number	Center frequency (MHz)	99% bandwidth (MHz)
38	5190	36.00
46	5230	36.64
62	5310	36.16
102	5510	36.00
110	5550	36.32
134	5670	36.16

FCC:BV5SMALLENGINE

802.11a mode:

Spectrum analyzer settings: RBW: 1 MHz

VBW: 3 MHz

Detector: Peak

Channel number	Center frequency (MHz)	99% bandwidth (MHz)
36	5180	17.36
48	5240	17.36
64	5320	17.36
100	5500	17.44
116	5580	17.44
140	5700	17.60

802.11a mode:

Channel number	Center frequency (MHz)	99% bandwidth (MHz)
36	5180	16.40
48	5240	16.48
64	5320	16.48
100	5500	16.48
116	5580	16.48
140	5700	16.48

Remarks:

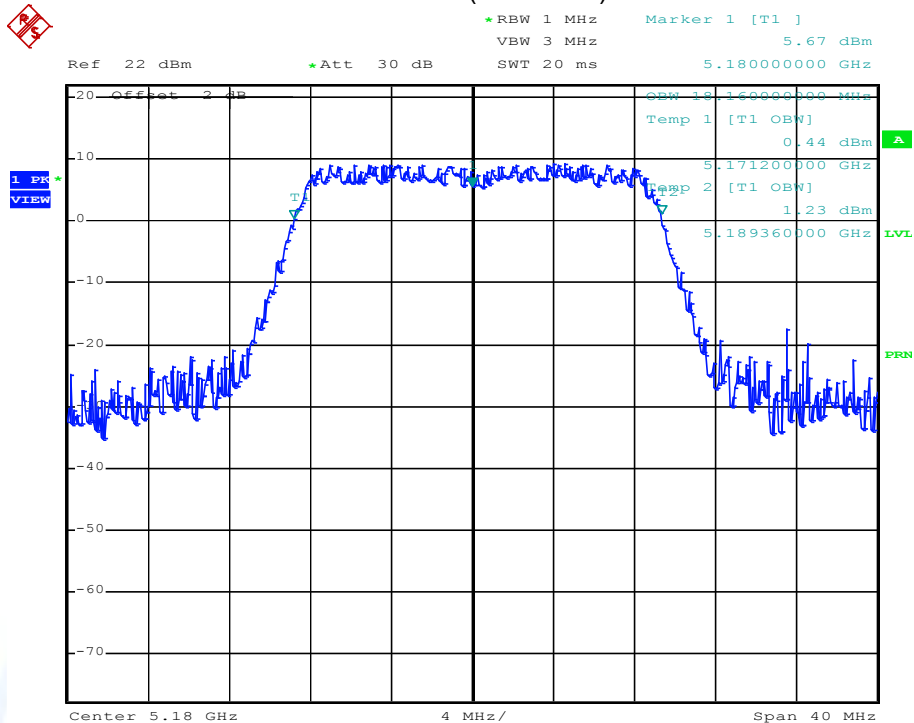
For detailed test result please refer to following test protocols. The RSS Gen defines no limit for the occupied bandwidth! Only the worst case plots are listed.

FCC:BV5SMALLENGINE

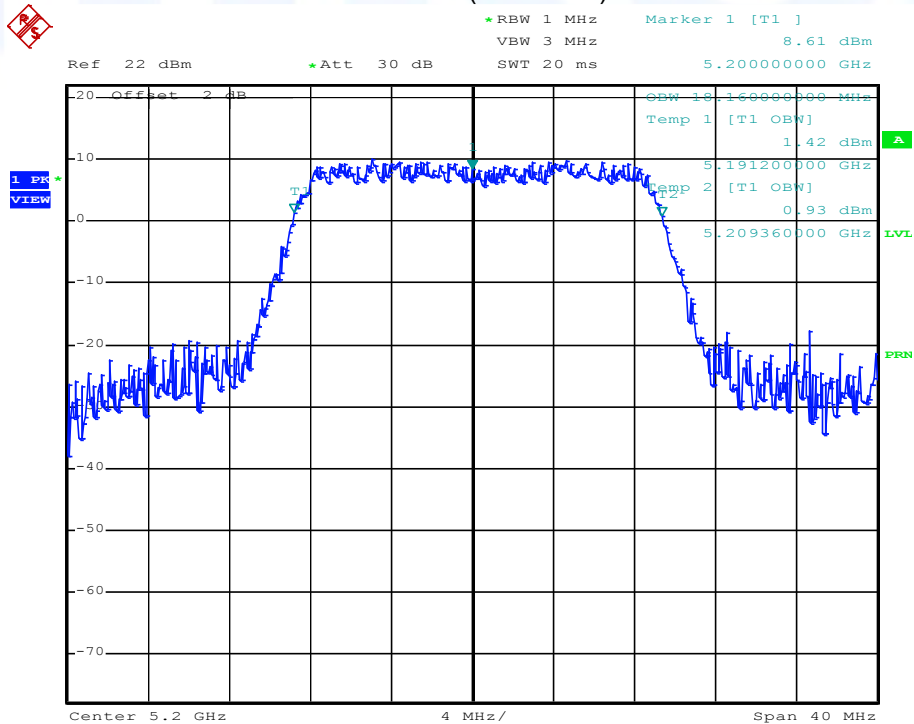
5.12.6 Test protocols

99% Bandwidth Measurement plots, HT20, Ant1

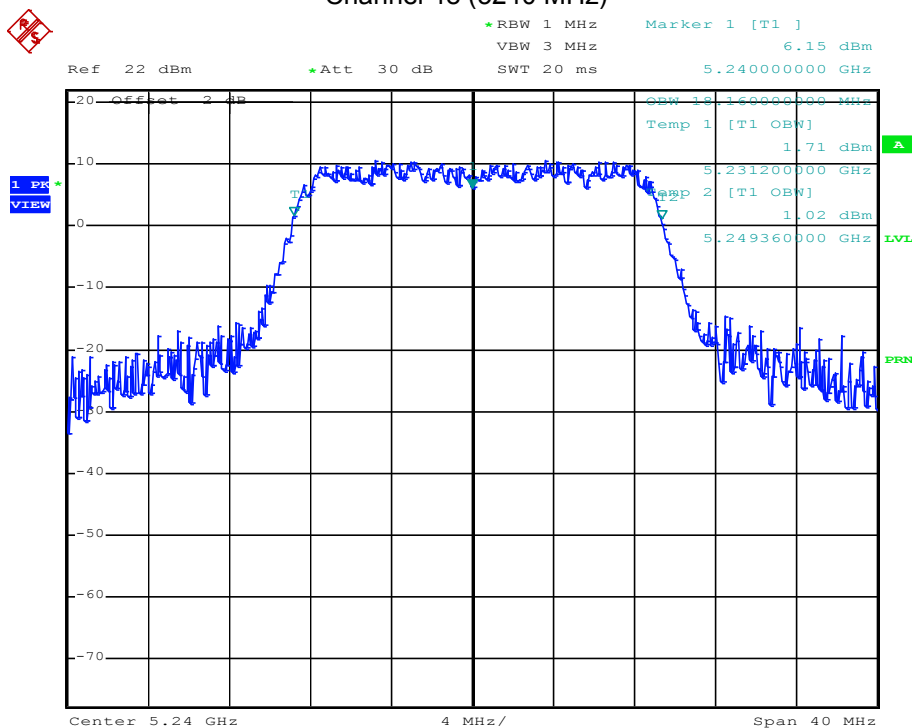
Channel 36 (5180 MHz)



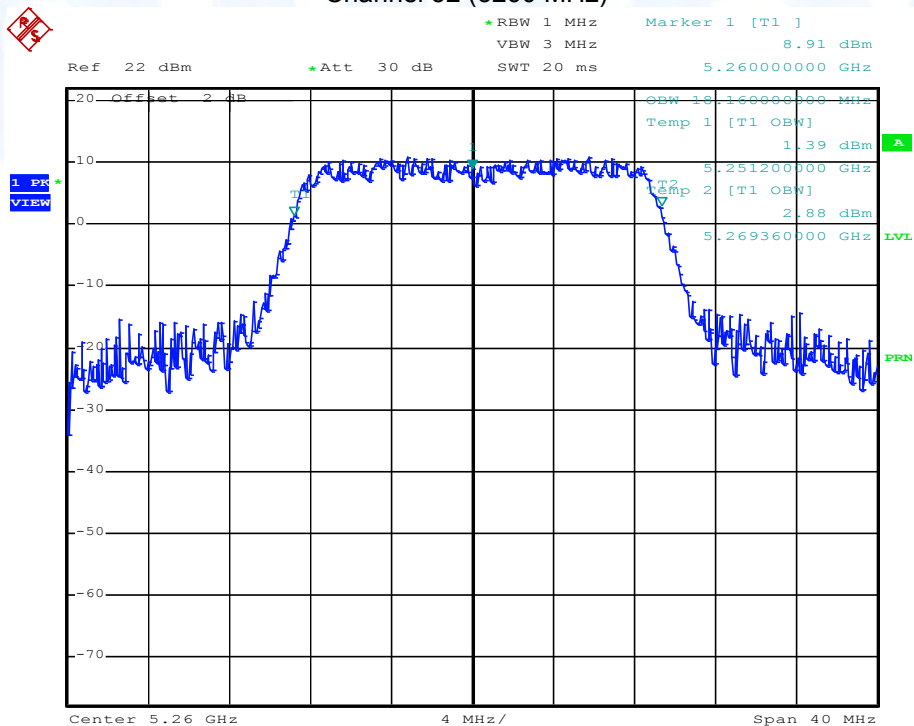
Channel 40 (5200 MHz)



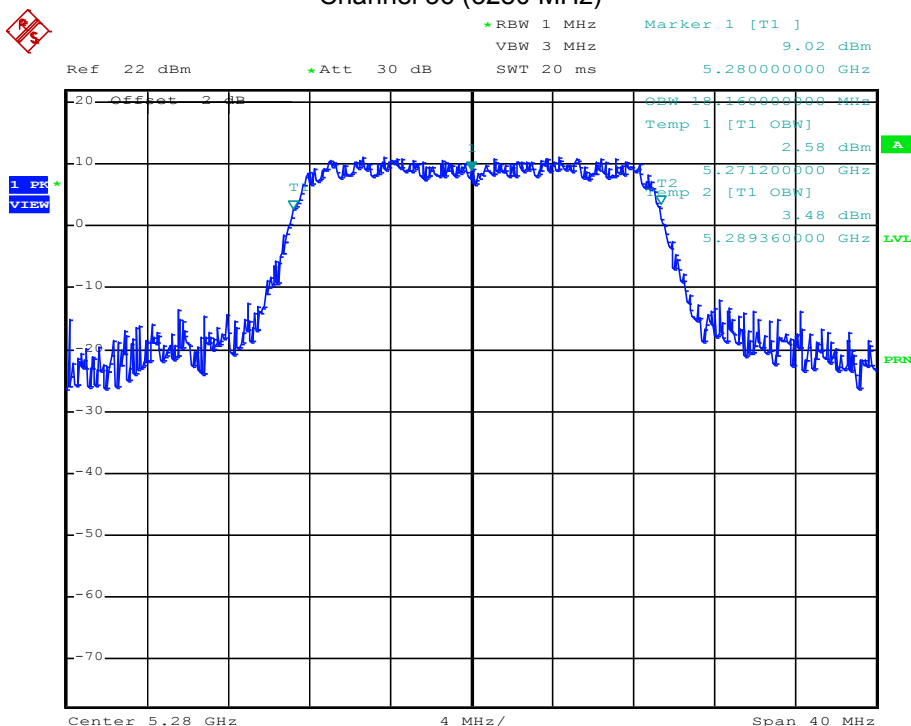
FCC:BV5SMALLENGINE Channel 48 (5240 MHz)



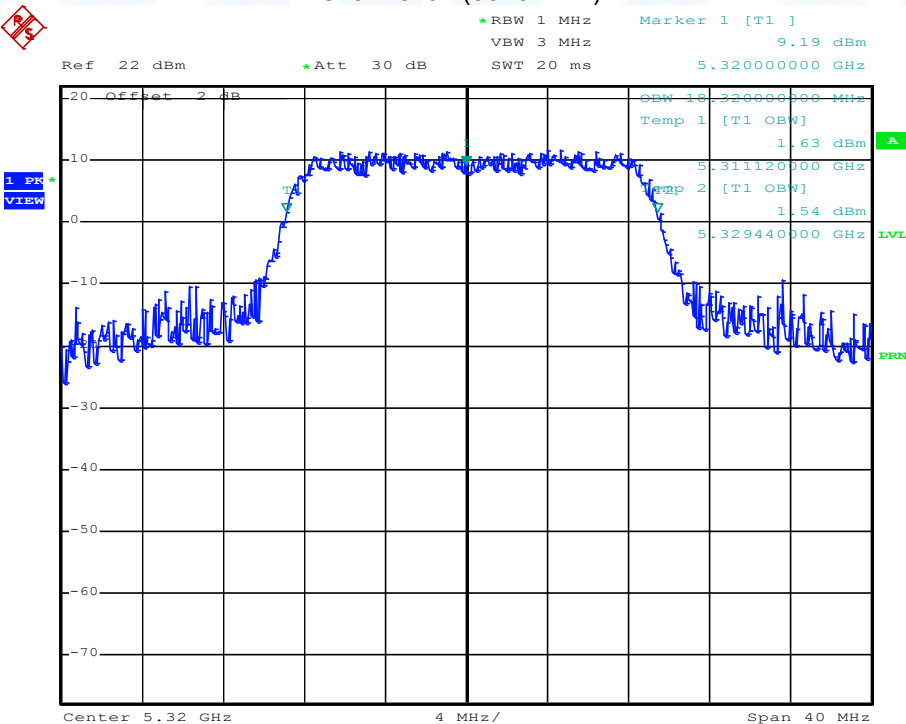
Channel 52 (5260 MHz)



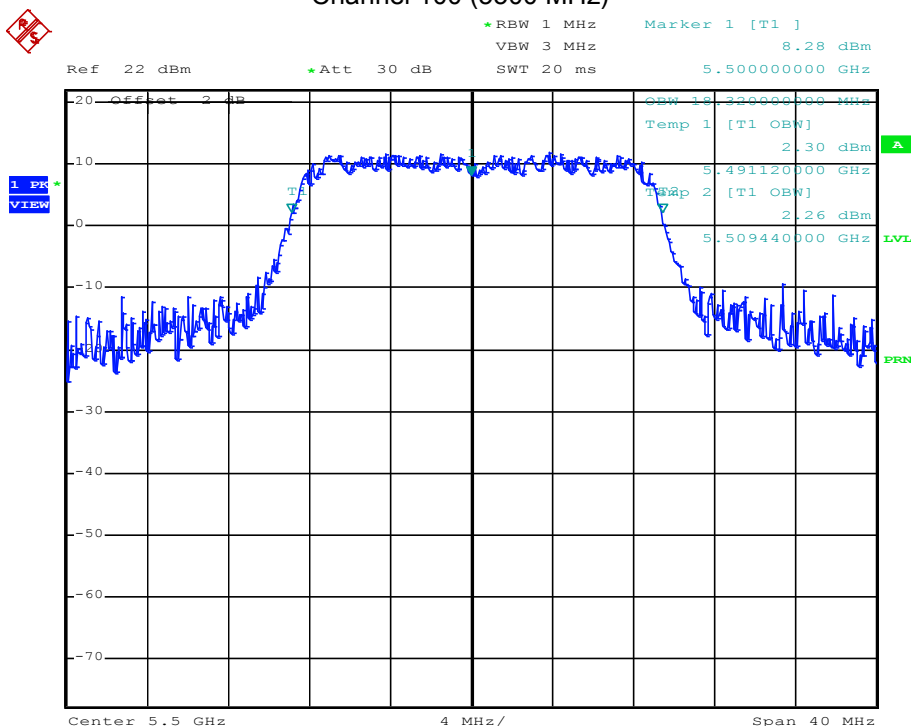
FCC:BV5SMALLENGINE Channel 56 (5280 MHz)



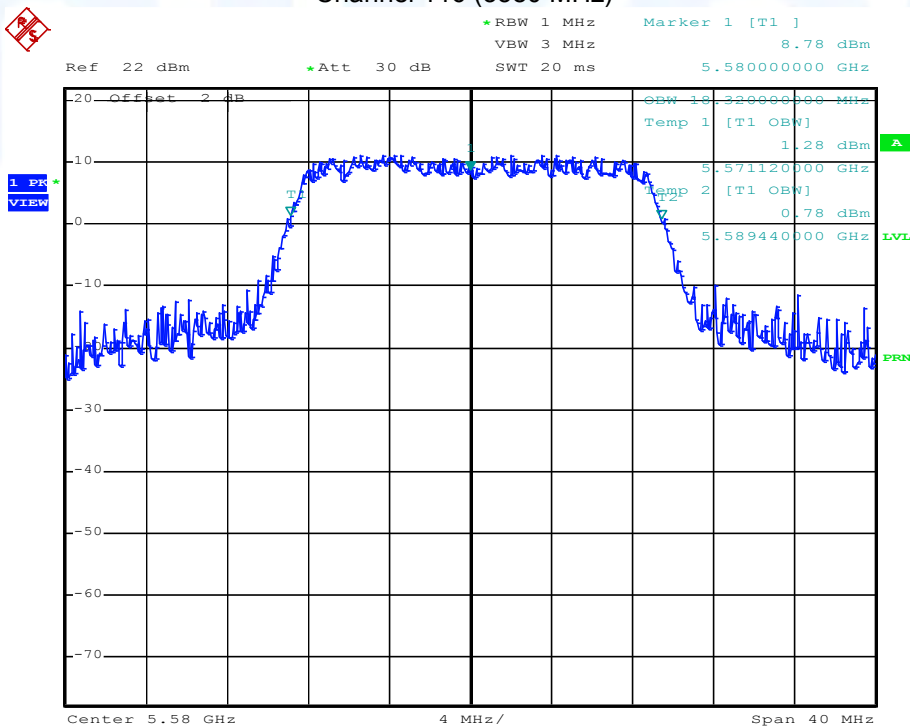
Channel 64 (5320 MHz)



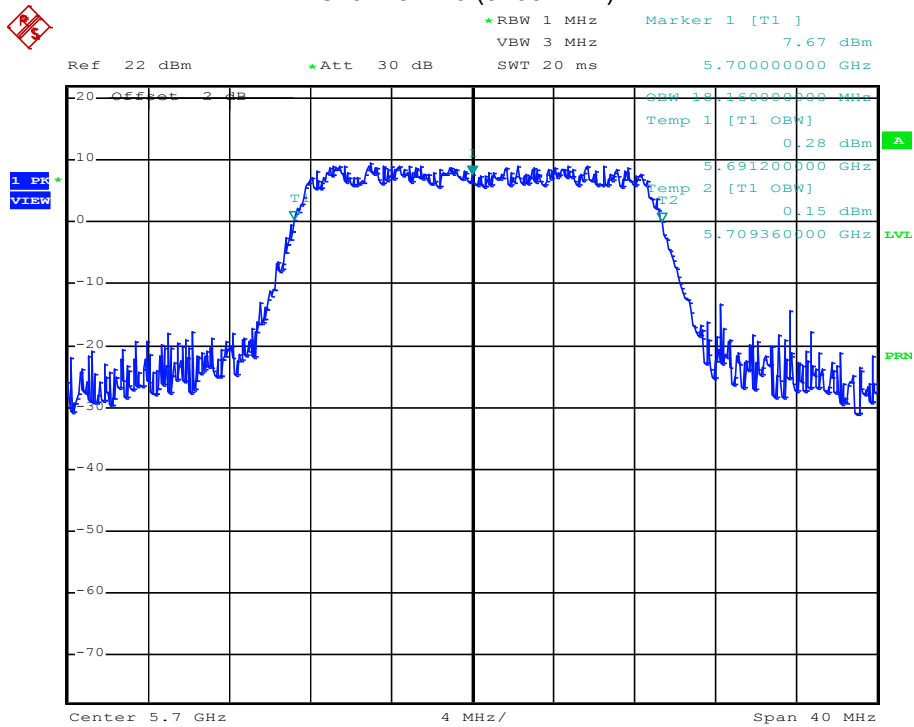
FCC:BV5SMALLENGINE Channel 100 (5500 MHz)



Channel 116 (5580 MHz)

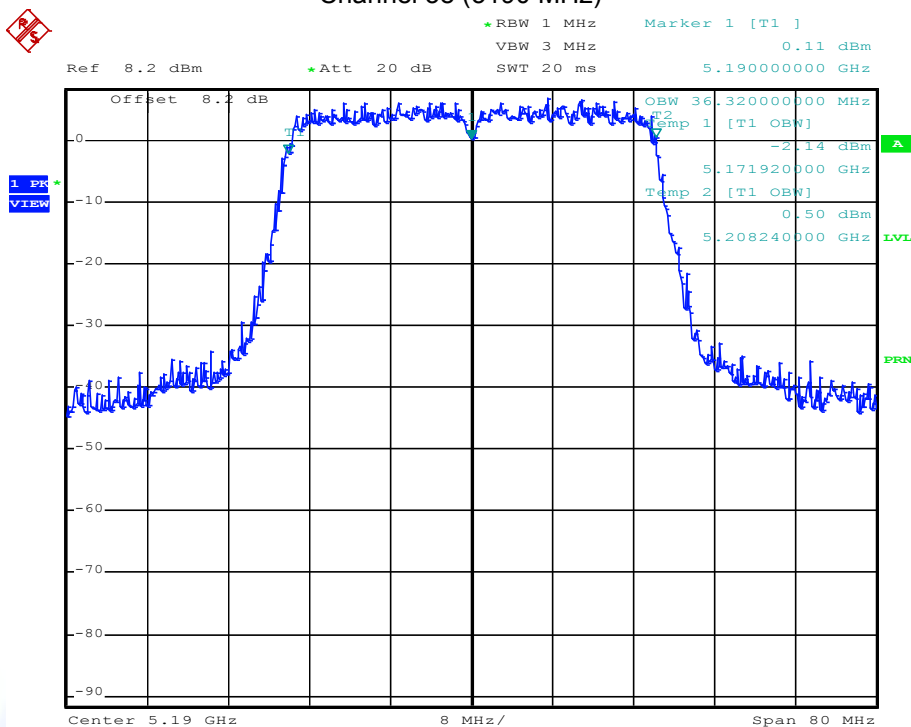


FCC:BV5SMALLENGINE Channel 140 (5700 MHz)

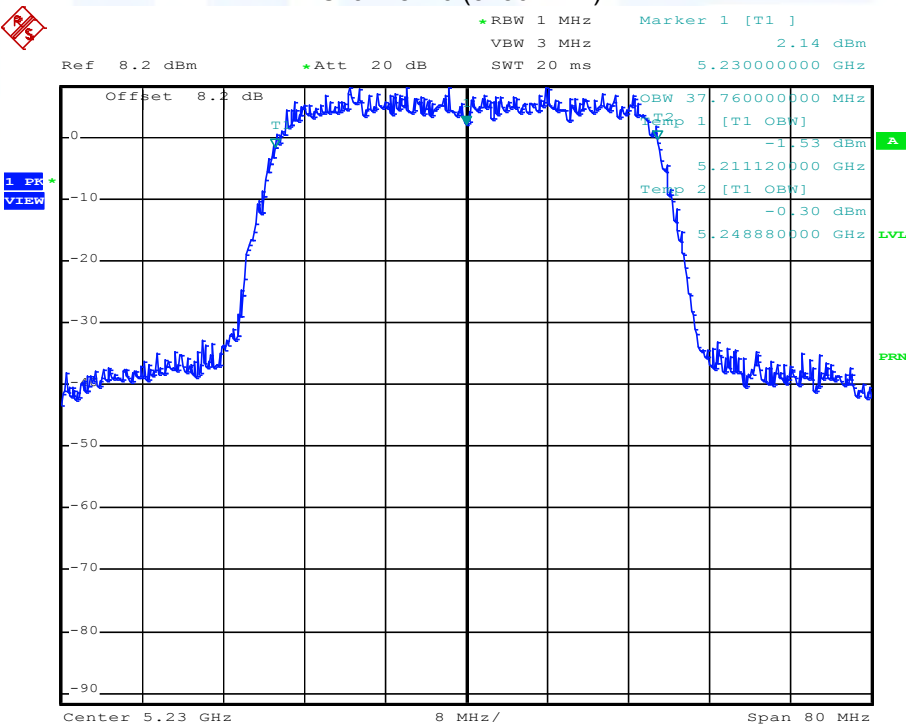


FCC:BV5SMALLENGINE
99% Bandwidth Measurement plots, HT40

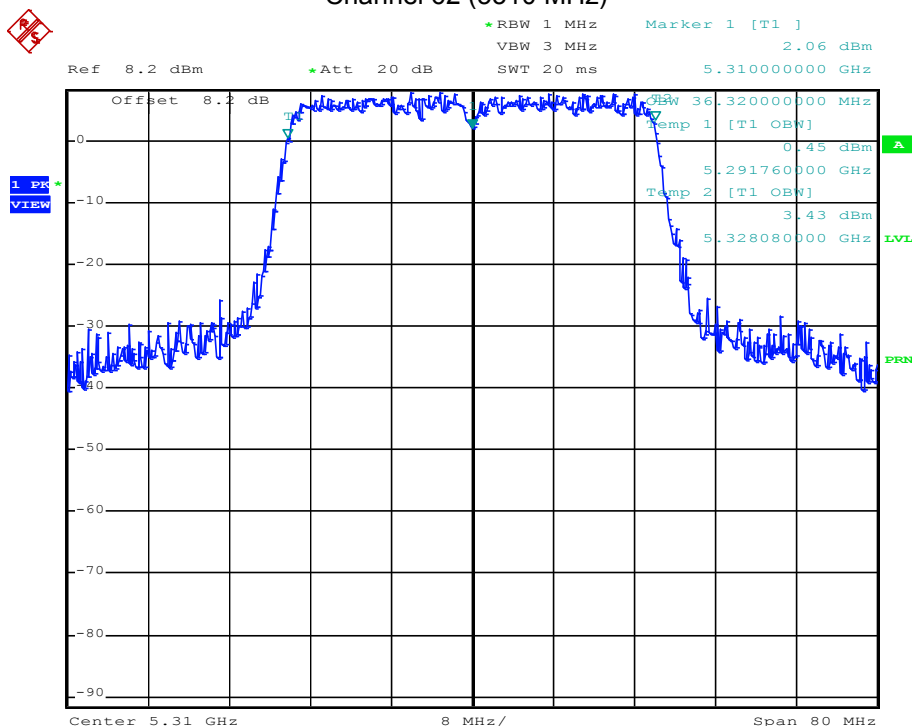
Channel 38 (5190 MHz)



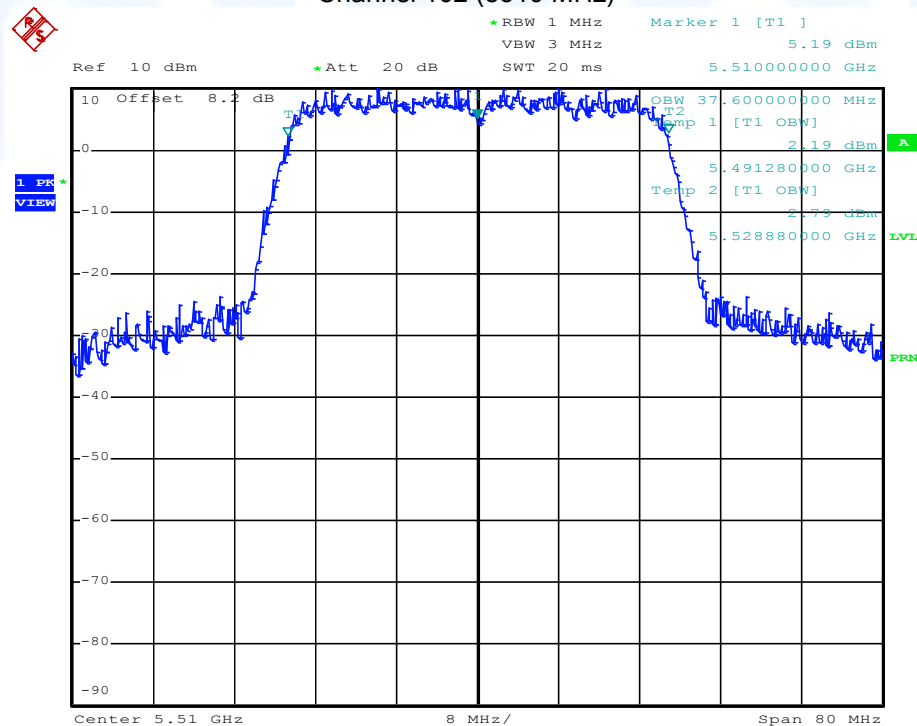
Channel 46 (5230 MHz)



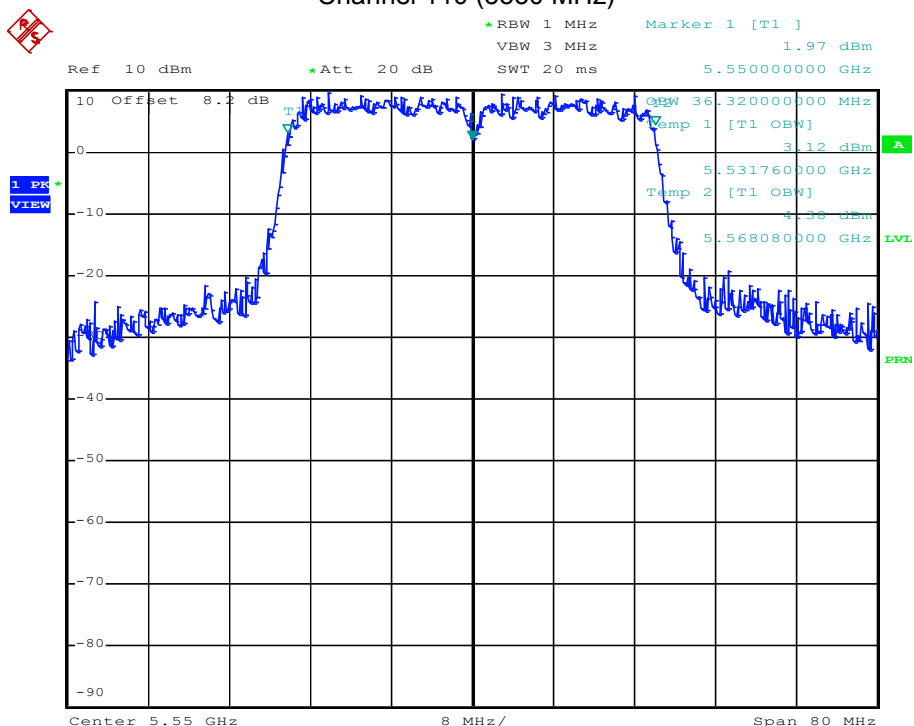
FCC:BV5SMALLENGINE Channel 62 (5310 MHz)



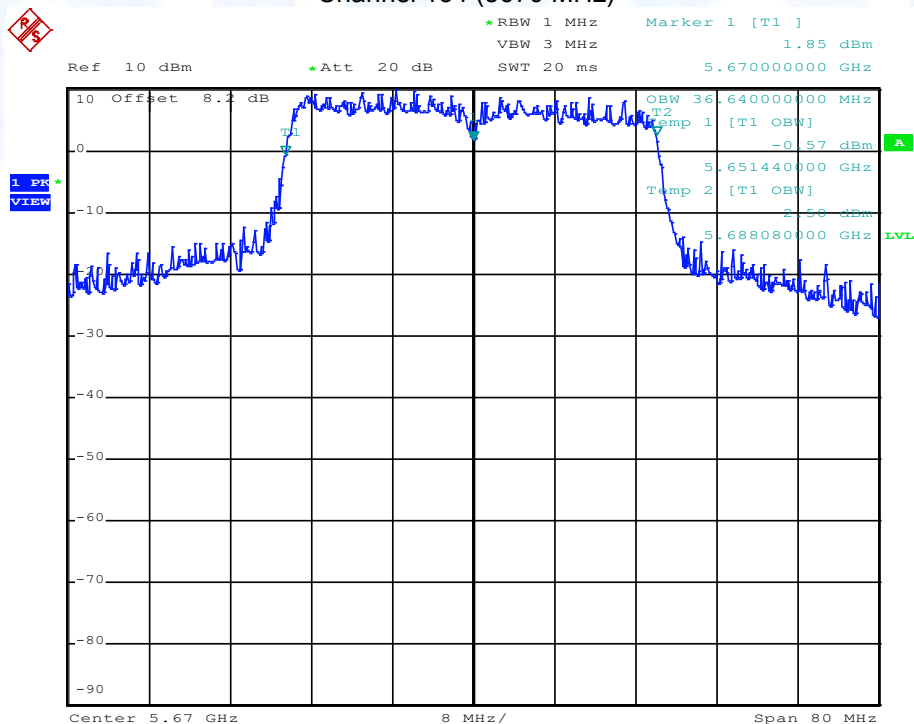
Channel 102 (5510 MHz)



FCC:BV5SMALLENGINE Channel 110 (5550 MHz)



Channel 134 (5670 MHz)



FCC:BV5SMALLENGINE

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	ESHS 30	02-02/03-05-002	18/06/2011	18/06/2010		
	ESH 2 - Z 5	02-02/20-05-004	12/05/2013	12/05/2011	12/11/2011	12/05/2011
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2	02-02/50-05-155			06/10/2011	06/04/2011
CPC 3	NRVS	02-02/07-05-005				
	NRV-Z15	02-02/07-07-001	27/07/2011	27/07/2010	02/02/2012	02/02/2011
	FSP 30	02-02/11-05-001	17/05/2012	17/05/2011		
	Multiflex 141-SMA-N-1500	02-02/50-09-013				
MB	FSP 30	02-02/11-05-001	17/05/2012	17/05/2011		
	WK-340/40	02-02/45-05-001	17/06/2011	17/06/2009	22/06/2011	22/12/2010
	Multiflex 141-SMA-N-1500	02-02/50-09-013				
SER 1	FMZB 1516	01-02/24-01-018			16/02/2012	16/02/2011
	ESCI	02-02/03-05-005	19/11/2011	19/11/2010		
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 2	ESVS 30	02-02/03-05-006	11/06/2011	11/06/2010		
	VULB 9168	02-02/24-05-005	07/03/2012	07/03/2011	17/09/2011	17/03/2011
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 3	FSP 30	02-02/11-05-001	17/05/2012	17/05/2011		
	AFS4-01000400-10-10P-4	02-02/17-05-003				
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	BBHA 9120 E 251	02-02/24-05-006			09/09/2011	09/03/2011
	WBH2-18HN	02-02/24-05-007				
	3117	02-02/24-05-009	11/02/2012	11/02/2011		
	R2 _ 30 - 40 GHz	02-02/30-09-001			02/02/2012	02/02/2011
	R1 _ 18 - 30 GHz	02-02/30-09-002			02/02/2012	02/02/2011
	Sucoflex N-1000-SMA	02-02/50-05-072				
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	WHKX 7.5/18G-8SS	02-02/50-07-010				
	Multiflex 141-SMA-N-1500	02-02/50-09-015				
	Multiflex 141-SMA-N-1500	02-02/50-09-016				
	H26G40G1	02-02/50-10-011				