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TEST REPORT

Test report no.: 1-0278/15-01-02-A



Deutsche
Akkreditierungsstelle
D-PL-12076-01-00

Testing laboratory

CETECOM ICT Services GmbH

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Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-00

Applicant

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Manufacturer

Becker Avionics GmbH

Baden Airpark Gebäude B108

77836 Rheinmünster / GERMANY

Test standard/s

FCC 47 CFR Part 87 AVIATION SERVICES

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item: VHF-Transceiver

Model name: RT-6512-(200)

FCC ID: B54RT6512

Frequency: 118.000 MHz – 136.975 MHz

Antenna: External antenna

Power supply: Vnom 28.0 V DC
(22.0 – 30.3 V DC) from power supply

Temperature range: - 40°C to + 70°C



This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

Michael Berg
Lab Manager
Radio Communications & EMC

Test performed:

Meheza Walla
Lab Manager
Radio Communications & EMC

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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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2.2 Application details

Date of receipt of order:	2015-07-29
Date of receipt of test item:	2015-09-22
Start of test:	2015-09-22
End of test:	2015-09-25
Person(s) present during the test:	Mr. Töpler

3 Test standard/s and references

Test standard	Date	Description
FCC 47 CFR Part 87	-/-	AVIATION SERVICES

4 Test environment

Temperature	:	T _{nom} T _{max} T _{min}	+ 22 °C during room temperature tests + 70 °C during high temperature tests - 40 °C during low temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V _{nom} V _{max} V _{min}	28.0 V DC 30.3 V DC 22.0 V DC

5 Test item

5.1 General description

Kind of test item	:	VHF-Transceiver
Type identification	:	RT-6512-(200)
S/N serial number	:	00109
HW hardware status	:	-/-
SW software status	:	SCI 1025 S305 SCI 1088 S305 SCI 1089 S305
Frequency band	:	118.000 MHz – 136.975 MHz
Test operation frequency	:	118 MHz - 127.5 MHz - 136.975 MHz
Type of radio transmission	:	AM
Use of frequency spectrum	:	AM
Type of modulation	:	5K60A3E, 6K00A3E
Number of channels	:	760 (25 kHz) resp. 2280 (8.33 kHz)
Antenna	:	External antenna
Power supply	:	V _{nom} 28.0 V DC (22.0 – 30.3 V DC) from power supply
Temperature range	:	- 40°C to + 70°C

5.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report:

- 1-0278/15-01-02_AnnexA (Test Setup)
- 1-0278/15-01-02_AnnexB (External Photos)
- 1-0278/15-01-02_AnnexC (Internal Photos)

6 Test laboratories sub-contracted

None

7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

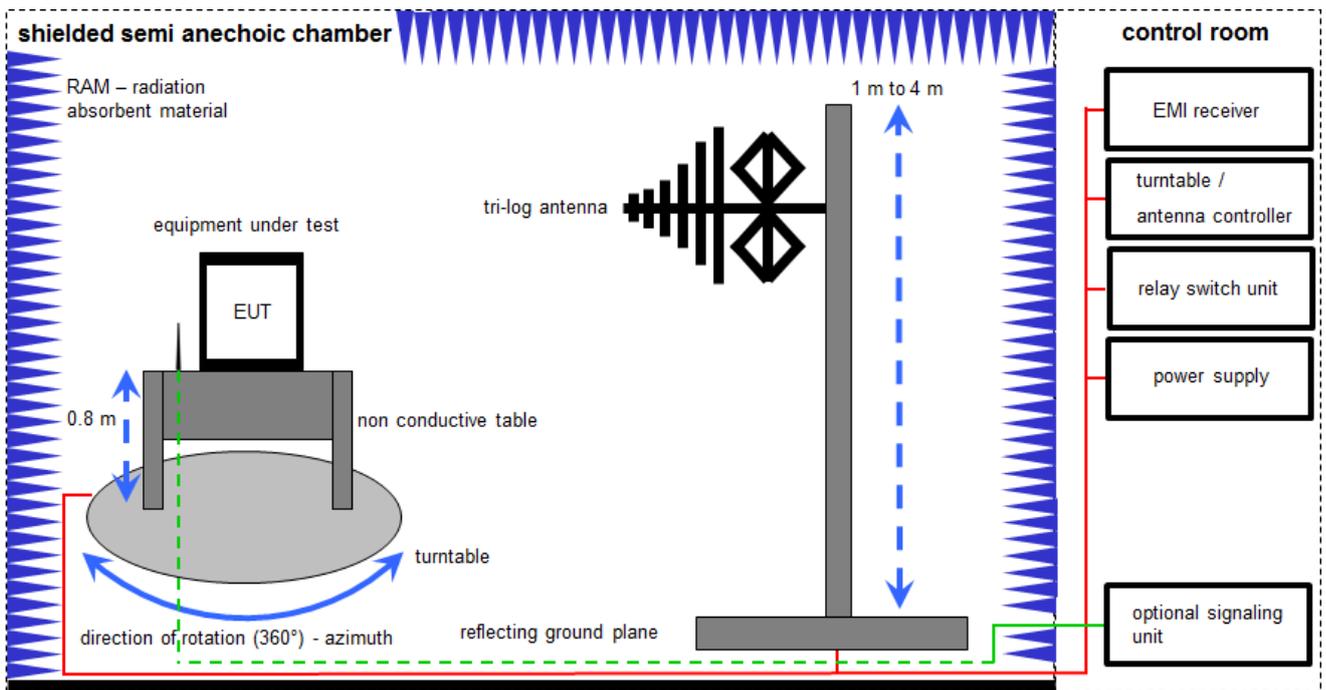
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

k	calibration / calibrated		EK	limited calibration
ne	not required (k, ev, izw, zw not required)		zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification		izw	internal cyclical maintenance
Ve	long-term stability recognized		g	blocked for accredited testing
vK!	Attention: extended calibration interval			
NK!	Attention: not calibrated		*)	next calibration ordered / currently in progress

7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter

$$FS = UR + CL + AF$$

(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

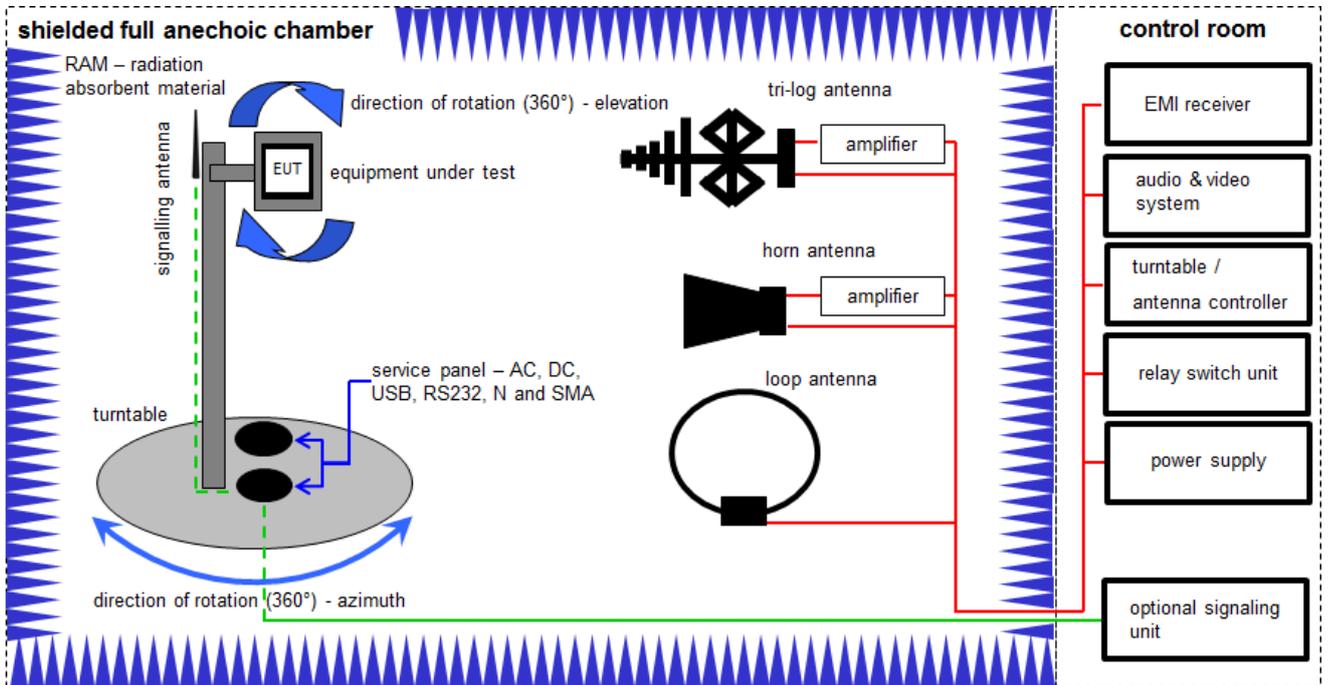
Example calculation:

$$FS [dB\mu V/m] = 12.35 [dB\mu V/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] (35.69 \mu V/m)$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev		
2	A	software	SPS_PHE 1.4f	Spitzenberger & Spiess	B5981; 5D1081;B5979	300000210	ne		
3	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
4	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	11.02.2014	11.02.2016
5	A	Amplifier	JS42-00502650-28-5A	MITEQ	1084532	300003379	ev		
6	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw		
7	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw		
8	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw		
9	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016

7.2 Shielded fully anechoic chamber



Measurement distance: tri-log antenna and horn antenna 3 meter; loop antenna 3 meter

$$FS = UR + CA + AF$$

(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:

$$FS [dB\mu V/m] = 40.0 [dB\mu V/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dB\mu V/m] (71.61 \mu V/m)$$

$$OP = AV + D - G + CA$$

(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

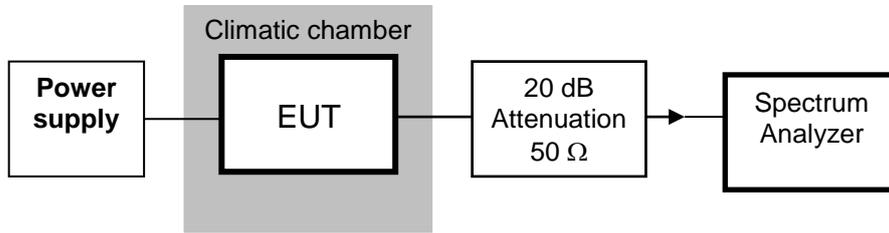
Example calculation:

$$OP [dBm] = -39.0 [dBm] + 57.0 [dB] - 12.0 [dBi] + (-36.0) [dB] = -30 [dBm] (1 \mu W)$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9709-5290	300000212	k	13.08.2015	13.08.2017
2	A	EMI Test Receiver 20Hz- 26.5GHz	ESU26	R&S	100037	300003555	k	22.01.2015	22.01.2016
3	A	Highpass Filter	WHK1.1/15G-10SS	Wainwright	37	400000148	ne		
4	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
5	A	Band Reject Filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	26	300003792	ne		
6	A	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22050	300004482	ev		
7	A	Broadband Amplifier 5-13 GHz	CBLU5135235	CERNEX	22011	300004492	ev		
8	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne		
9	A	Messrechner und Monitor	Intel Core i3 3220/3,3 GHz, Prozessor	Agilent Technologies	2V2403033A54 21	300004591	ne		
10	A	NEXIO EMV-Software	BAT EMC	EMCO	2V2403033A54 21	300004682	ne		
10	A	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	24.06.2015	24.06.2017

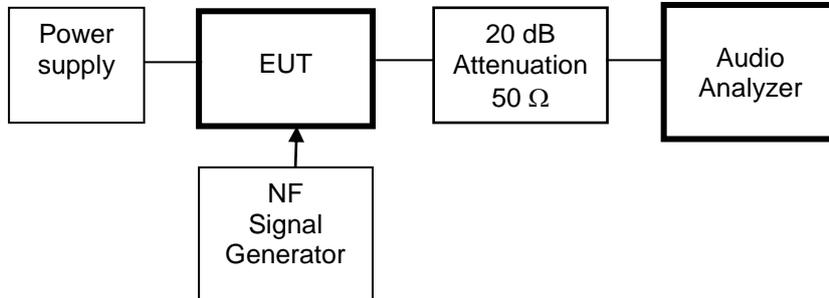
7.3 Conducted measurements



Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	PXA Spectrum Analyzer 3Hz to 50 GHz	N9030A PXA	Agilent Technologies	US51350267	300004338	k	17.01.2015	17.01.2016
2	A	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	Ve	02.10.2014	02.10.2016
3	-/-	Power Supply	E 030 - 10	Delta Elektronika	02340	From customer			
4	A	Temperature and Climatic Test Chamber	T40/50	CTS	064023	300000297	ev	03.09.2015	03.09.2017
5	A	Fixed Coaxial Attenuatr 20 dB	WA36-20-34	Weinschel Ass	A1703	300004267	K, zw, ev, izw		

7.4 Conducted intermodulation measurements



Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	PXA Spectrum Analyzer 3Hz to 50 GHz	N9030A PXA	Agilent Technologies	US51350267	300004338	k	17.01.2015	17.01.2016
2	A	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	Ve	02.10.2014	02.10.2016
3	-/-	Power Supply	E 030 - 10	Delta Elektronika	02340	From customer			
4	A	Radiocommunication Analyzer	CMTA 84	R&S	894199/012	300001176	Ve	29.01.2014	29.01.2016
4	A	Audio Analyzer	UPD	R&S	841074/099	300001176	Ve	28.01.2014	28.01.2016
5	A	Fixed Coaxial Attenuatr 20 dB	WA36-20-34	Weinschel Ass	A1703	300004267	K, zw, ev, izw		

8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.

- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.5 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the premeasurement are maximized by the software by rotating the turntable from 0° to 360°. In case of the 2-axis positioner is used the elevation axis is also rotated from 0° to 360°.
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

8.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position $\pm 45^\circ$ and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

8.3 Sequence of testing radiated spurious 1 GHz to 12.75 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

9 Measurement uncertainty

RF-Power	± 1.9 dB
Temperature	± 0.2 °C
Frequency	± 0.01 ppm
Spectrum masks	± 1.9 dB; ± 0.01 ppm
Spurious emissions	± 3.0 dB; ± 0.01 ppm

10 Summary of measurement results

- No deviations from the technical specifications were ascertained**
- There were deviations from the technical specifications ascertained
- This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	FCC 47 CFR § 87		2016-02-22	-/-

Test Specification Clause	Test Case	Temperature Conditions	Power Source Voltages	Pass	Fail	NA	NP	Remark
FCC 47 CFR § 2.1046 § 87.131	RF Power Output	Nominal Extreme	Nominal Extreme	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC 47 CFR § 2.1047 (a), § 87.141 (f)	Modulation Characteristics Audio Frequency Response of Lowpass Filter	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC 47 CFR § 2.1047 (b), § 87.141	Modulation Characteristics Modulation Limiting	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC 47 CFR § 2.1049, § 87.135, § 87.139	Occupied Bandwidth	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC 47 CFR § 2.1051, § 87.139 (a)	Emission Mask	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC 47 CFR § 2.1051, § 2.1057 § 87.139 (a)	Spurious emissions at Antenna Terminal	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC 47 CFR § 2.1053, § 2.1057 § 87.139 (a)	Field Strength of Spurious Emissions (Radiated)	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC 47 CFR § 2.1055, § 87.133 (5)	Frequency Stability	Nominal Extreme	Nominal Extreme	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-

Note: NA = Not Applicable; NP = Not Performed

10.1 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

11 Measurement results

11.1 RF Output § 2.1046 & § 87.131

Test conditions: TX Frequencies F = 118.000 - 127.500 - 136.975 MHz
 Modulation M = Modulation Off
 Power Supply V nom = 28.0 V
 V min = 22.0 V
 V max = 30.3 V
 Temperature T nom = 23.0 °C
 T min = - 40.0 °C
 T max = 70.0 °C

FCC Limit § 2.1046 & 87.131: 55 W (Aircraft (Communication), VHF, A3E)

Test result:

TX Frequency (MHz)	Temperature (°C)	Output power P (dBm)
118.000 000	- 40°C	43.3
118.000 000	+ 23°C	43.5
118.000 000	+ 70°C	43.1
127.500 000	- 40°C	43.3
127.500 000	+ 23°C	43.5
127.500 000	+ 70°C	40.1
136.975 000	- 40°C	43.2
136.975 000	+ 23°C	43.5
136.975 000	+ 70°C	40.1

Result: The measurement is passed.

11.2 Modulation Characteristics

11.2.1 Audio Frequency Response § 2.1047(a) & § 87.141(f)

Test conditions: TX Frequencies F = 118.000 - 127.500 - 136.975 MHz
 Modulation Frequency Fm = 1 000 Hz
 Modulation depth m = 76.0 %
 Power Supply V nom = 28.0 V
 Temperature T nom = 23.0 °C

FCC Limit § 2.1047(a) & 87.141(f)

Test result:

Frequency (kHz)	25 kHz		8.33 kHz	
	Attenuation wrt. 1 kHz (dB)	Recommended Attenuation (dB)	Attenuation wrt. 1 kHz (dB)	Recommended Attenuation (dB)
	0.1	- 31	--	- 31
0.2	- 0.2	--	- 0.2	--
0.4	- 0.2	--	- 0.2	--
0.6	- 0.2	--	- 0.2	--
0.8	- 0.1	--	- 0.1	--
1.0	± 0	--	± 0	--
1.5	- 0.1	--	- 0.1	--
2.0	- 0.1	--	- 0.1	--
2.5	- 0.6	--	- 0.8	--
3.0	- 0.9	0	- 11	0
3.5	- 1.3	-3	- 30	-3
4.0	- 12	-5	- 31	-5
4.5	- 35	-7	- 32	-7
5.0	- 36	-9	- 32	-9
6.0	- 38	-12	- 33	-12
7.0	- 38	-15	-45	-15
8.0	< - 45	-17	< - 60	-17
9.0	< - 54	-19	< - 60	-19
10.0	< - 58	-21	< - 60	-21
12.0	< - 58	-24	< - 60	-24
14.0	< - 58	-27	< - 60	-27
16.0	< - 58	-28	< - 60	-28
18.0	< - 58	-28	< - 60	-28
20.0	< - 58	-28	< - 60	-28
25.0	< - 58	-28	< - 60	-28
30.0	< - 58	-28	< - 60	-28
35.0	< - 58	-28	< - 60	-28
40.0	< - 58	-28	< - 60	-28
45.0	< - 58	-28	< - 60	-28
50.0	< - 58	-28	< - 60	-28

Result: The measurement is passed.

11.2.2 Modulation Limiting § 2.1047(b) & § 87.141(a)

Test conditions: TX Frequencies F = 118.000 - 127.500 - 136.975 MHz
 Power Supply V nom = 28.0 V
 Temperature T nom = 23.0 °C

FCC Limit § 2.1047(b) & 87.141(a): 100%

Test result:

MODULATING SIGNAL LEVEL (mV / rms)	8.33 kHz					MODULATION LIMIT (%)
	Modulation (%) at following modulating frequencies					
	0.1 kHz	0.5 kHz	1.0 kHz	3.0 kHz	5.0 kHz	
1	0.1	0.4	0.4	0.1	0.1	100
4	0.1	0.4	3.0	0.1	0.1	100
8	0.1	4.5	4.8	0.1	0.1	100
10	0.1	6.0	6.0	0.2	0.1	100
20	0.1	11	11	0.3	0.1	100
30	0.1	17	17	0.5	0.1	100
40	0.1	21	21	1.3	0.1	100
50	0.1	27	28	1.6	0.1	100
60	0.1	33	33	1.8	0.1	100
70	0.1	39	39	2.0	0.1	100
80	0.1	44	44	2.2	0.1	100
100	2.5	55	55	2.6	0.1	100
200	2.5	88	88	5.0	0.2	100
300	0.4	89	88	7.5	0.2	100
400	0.6	89	89	9.5	0.5	100
500	0.6	89	89	11.5	1.2	100
750	0.9	89	89	18	2.0	100
1000	2.5	89	89	24	2.0	100

Result: The measurement is passed.

Mod input – 120mV (20 dB over normal)

MODULATING FREQUENCY (KHz)	8.33 kHz	
	MODULATION (%)	MODULATION LIMIT (%)
0.1	2.5	100
0.2	35	100
0.4	78	100
0.6	87	100
0.8	87	100
1.0	86	100
1.2	86	100
1.4	85	100
1.6	83	100
1.8	82	100
2.0	80	100
2.5	80	100
3.0	25	100
3.5	20	100
4.0	1.5	100
4.5	1.0	100
5.0	0.2	100
6.0	0.1	100
7.0	0.1	100
8.0	0.1	100
9.0	0.1	100
10.0	0.1	100

Result: The measurement is passed.

MODULATING SIGNAL LEVEL	25 kHz					
	Modulation (%) at following modulating frequencies					MODULATION LIMIT (%)
	(mV / rms)	0.1 kHz	0.5 kHz	1.0 kHz	3.0 kHz	
1	0.1	0.4	0.4	0.4	0.1	100
4	0.1	2.5	2.5	2.5	0.1	100
8	0.1	4.5	4.5	4.0	0.1	100
10	0.1	5.8	5.5	5.0	0.1	100
20	0.1	11	11	10	0.1	100
30	0.1	16	16.5	15	0.1	100
40	0.1	22	22	20	0.1	100
50	0.2	26	26	25	0.1	100
60	0.1	32	32	30	0.1	100
70	0.1	39	39	35	0.1	100
80	0.1	44	44	40	0.1	100
100	2.4	55	55	50	0.1	100
200	2.7	88	88	80	0.2	100
300	0.4	88	88	80	0.2	100
400	0.6	89	88	79	0.3	100
500	0.6	89	88	79	0.4	100
750	1.7	89	89	79	0.5	100
1000	2.5	89	89	80	1.2	100

Result: The measurement is passed.

Mod input – 120mV (20 dB over normal)

MODULATING FREQUENCY (kHz)	25 kHz	
	MODULATION (%)	MODULATION LIMIT (%)
0.1	3	100
0.2	34	100
0.4	55	100
0.6	88	100
0.8	86	100
1.0	85	100
1.2	85	100
1.4	85	100
1.6	84	100
1.8	84	100
2.0	83	100
2.5	82	100
3.0	82	100
3.5	76	100
4.0	22	100
4.5	1.5	100
5.0	0.5	100
6.0	0.1	100
7.0	0.1	100
8.0	0.1	100
9.0	0.1	100
10.0	0.1	100

Result: The measurement is passed.

11.3 Occupied Bandwidth § 2.1049 & § 87.135

Test conditions: TX Frequencies F = 118.000 - 127.500 - 136.975 MHz
 Modulation Frequency Fm = 1 000 Hz
 Modulation depth m = 76.0 %
 Power Supply V nom = 28.0 V
 Temperature T nom = 23.0 °C

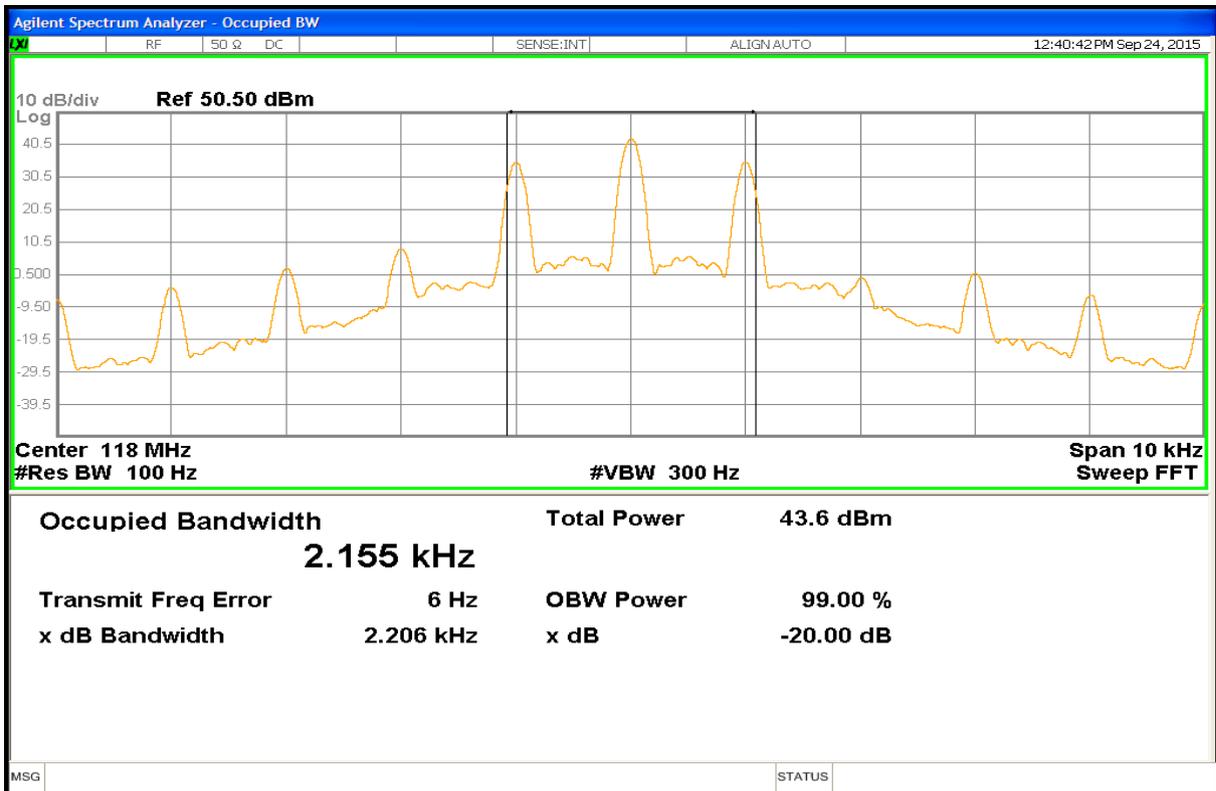
FCC Limit § 2.1049 & 87.135: 99% bandwidth

Test result:

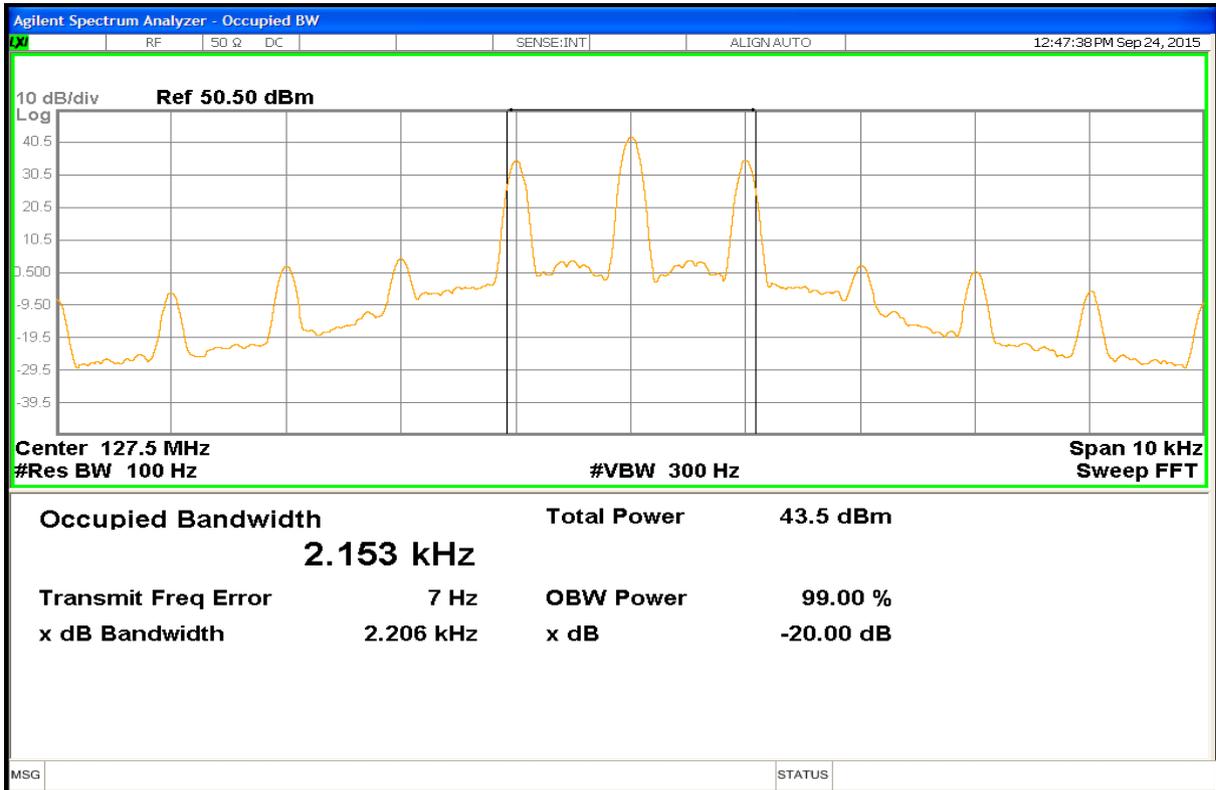
TX Frequencies MHz	99% Occupied Bandwidth (kHz)
118.000	2.155
127.500	2.153
136.975	2.154

Result: The measurement is passed.

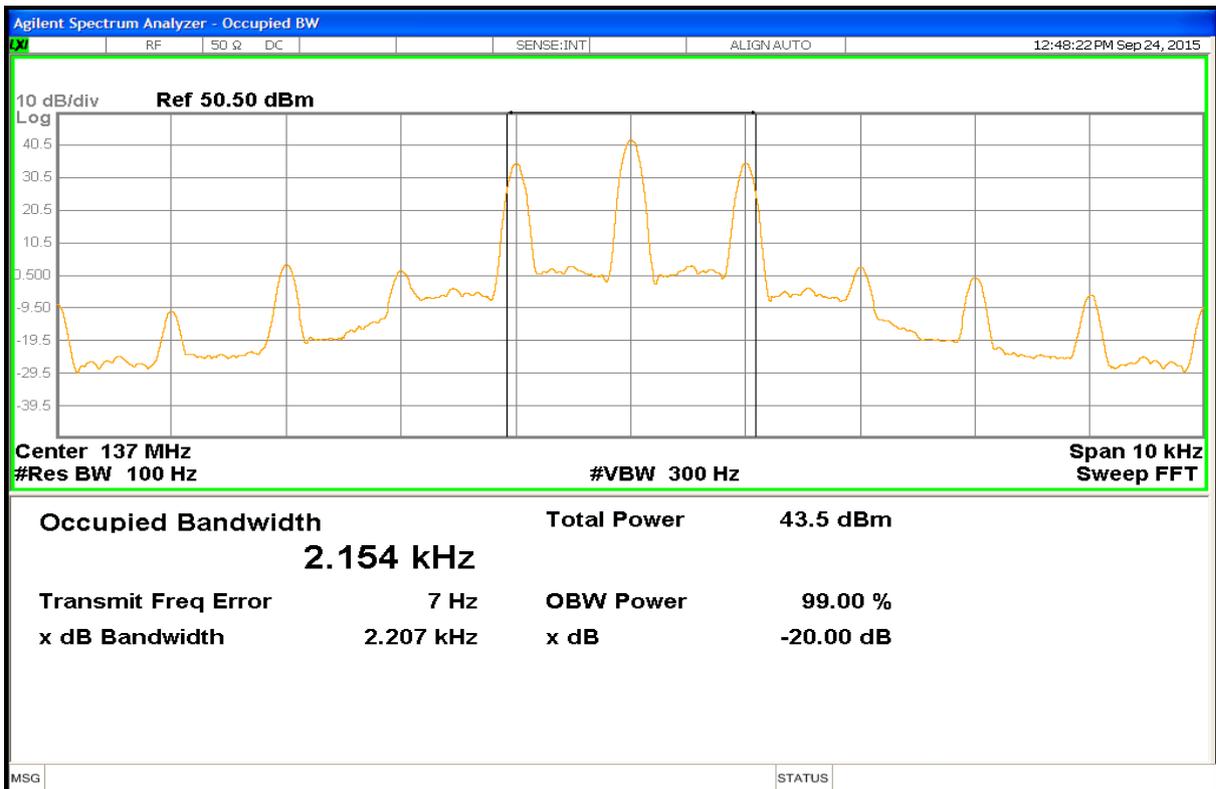
Plot No. 1: 118.000 MHz



Plot No. 2: 127.500 MHz



Plot No. 3: 136.975 MHz



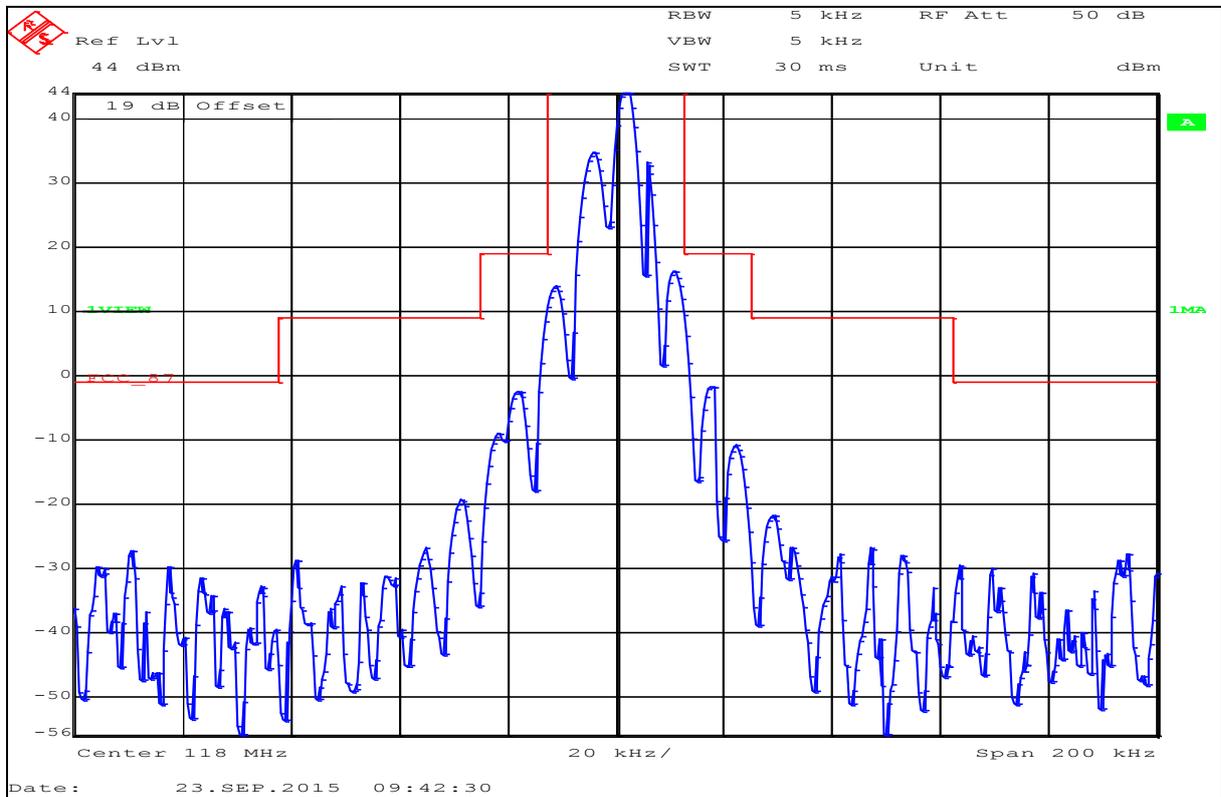
11.4 Emission Mask § 2.1051 & § 87.139 (a)

Test conditions: TX Frequencies F = 118.000 - 127.500 - 136.975 MHz
 Modulation Frequency Fm = 1 000 Hz
 Modulation depth m = 76.0 %
 Power Supply V nom = 28.0 V
 Temperature T nom = 23.0 °C

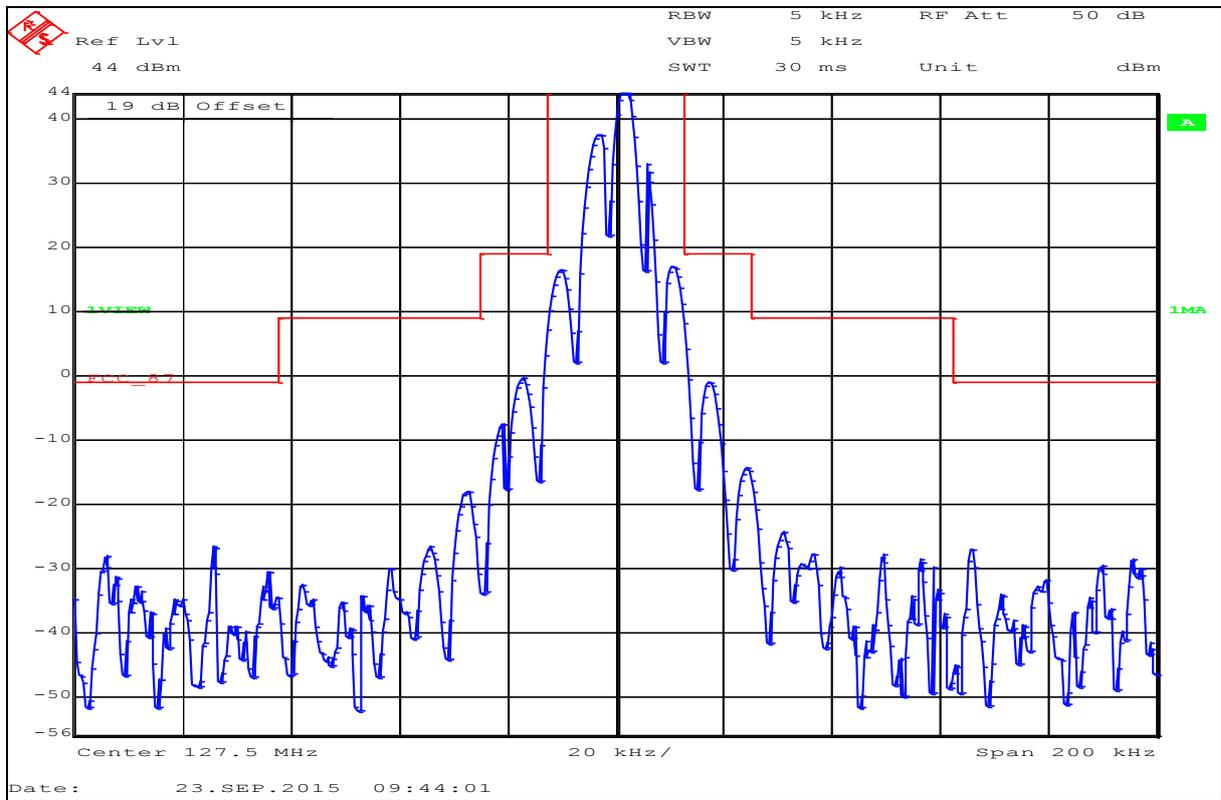
FCC Limit § 2.1049 & 87.139 (a)

Result: The measurement is passed.

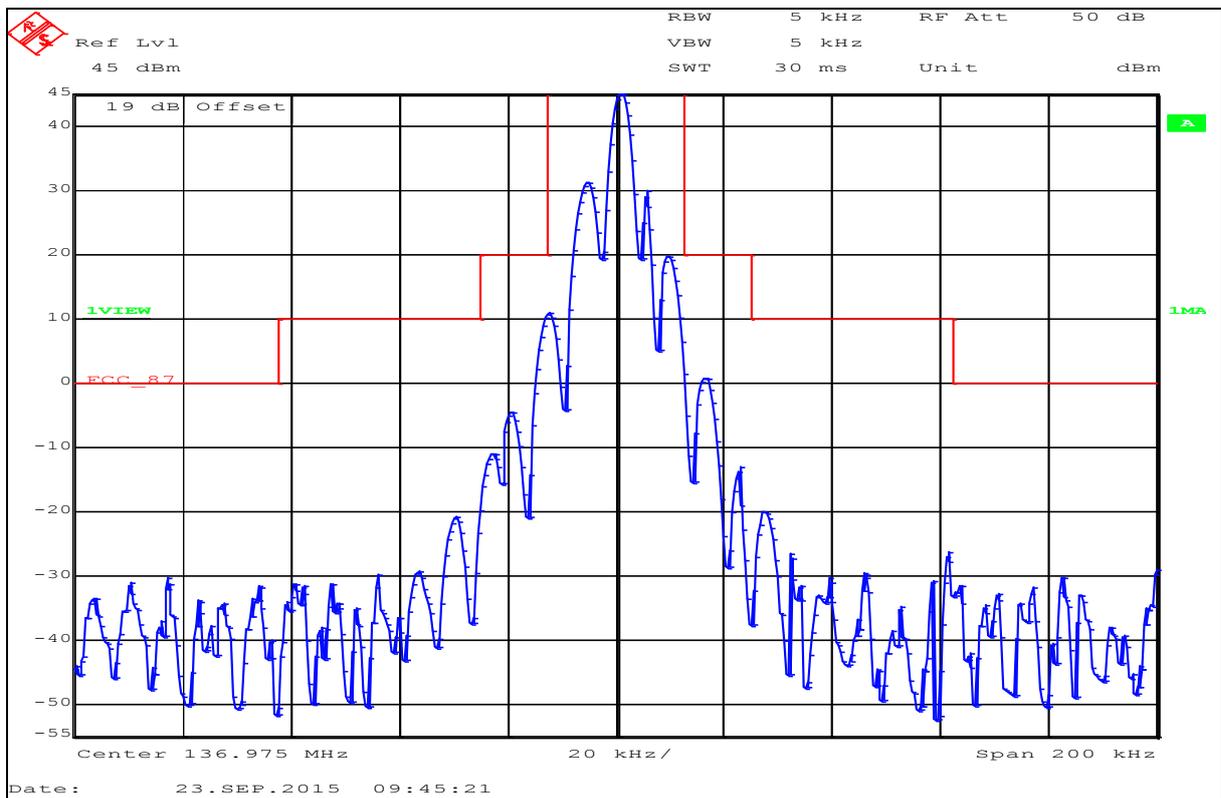
Plot No. 4: 118.000 MHz



Plot No. 5: 127.500 MHz



Plot No. 6: 136.975 MHz



11.5 Spurious Emissions at Antenna Terminal § 2.1051 & § 87.139 (a)

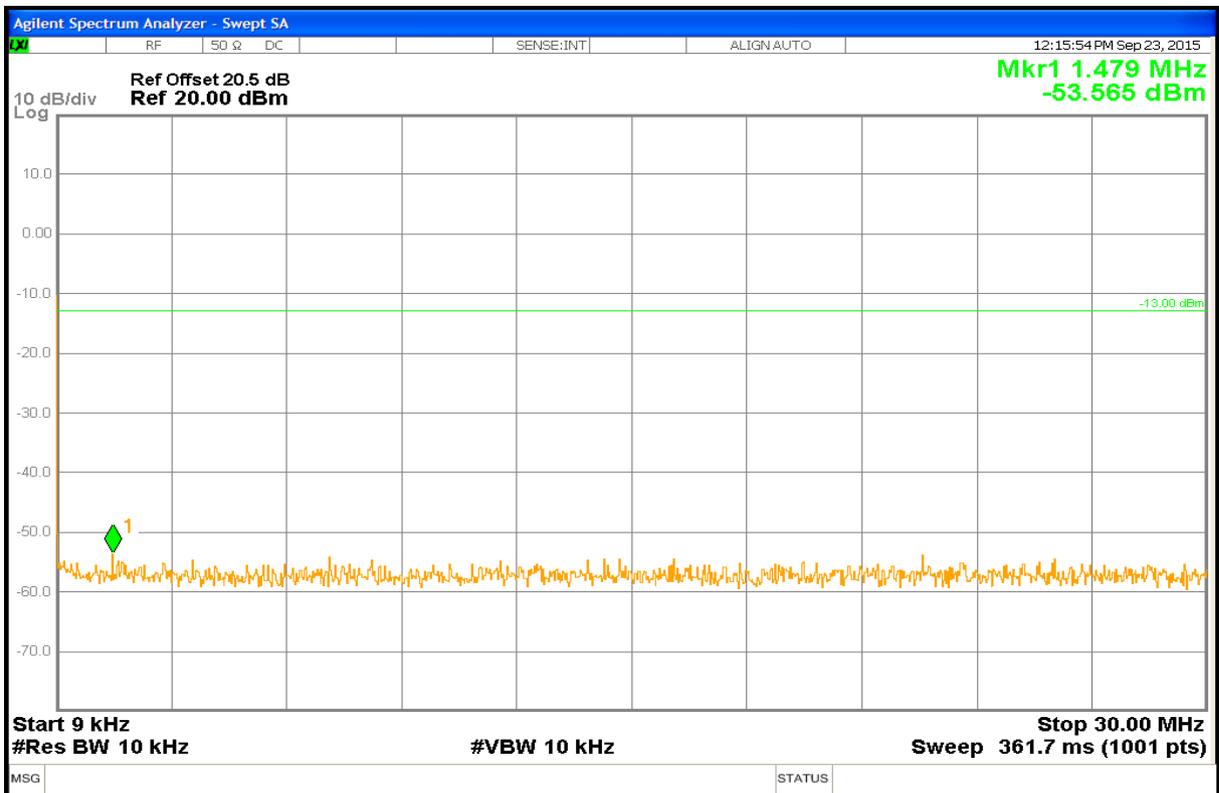
Test conditions: TX Frequencies F = 118.000 - 127.500 - 136.975 MHz
 Power Supply V nom = 28.0 V
 Temperature T nom = 23.0 °C

FCC Limit § 2.1051 & 87.139(a): -13 dBm

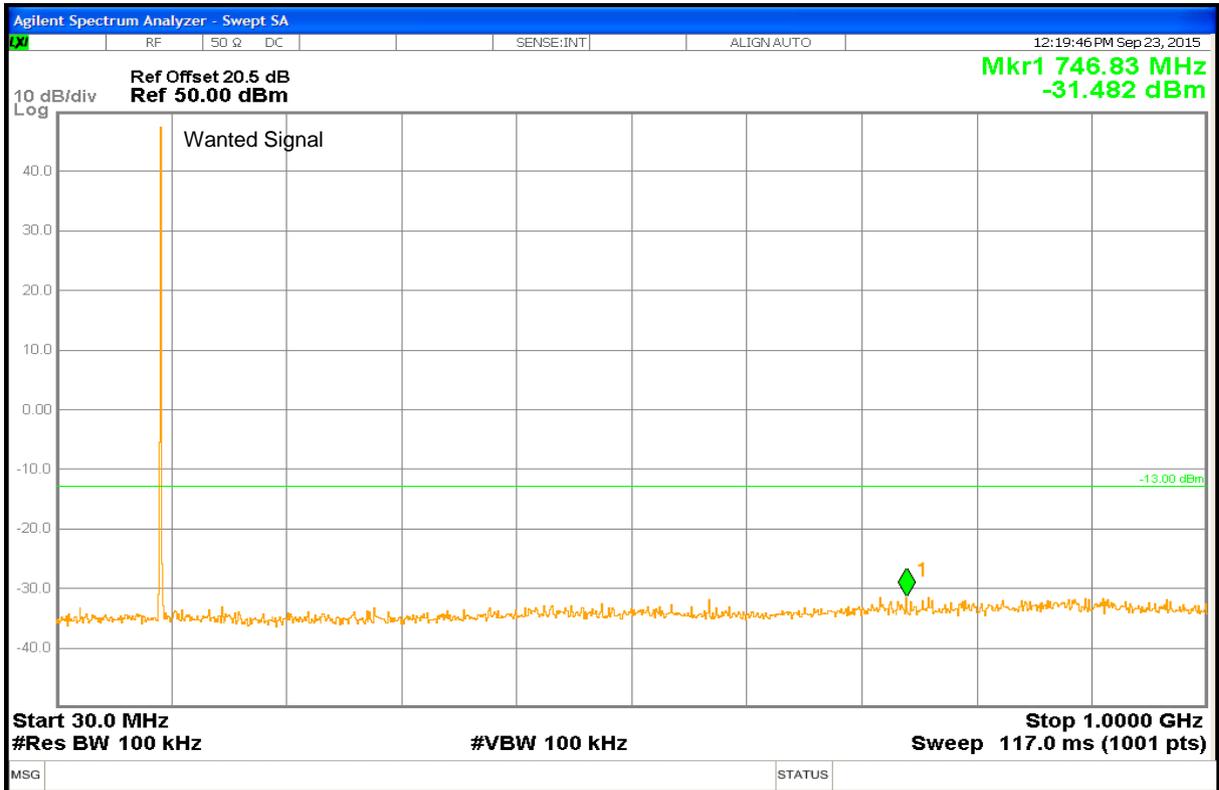
No critical peaks found!

Result: The measurement is passed.

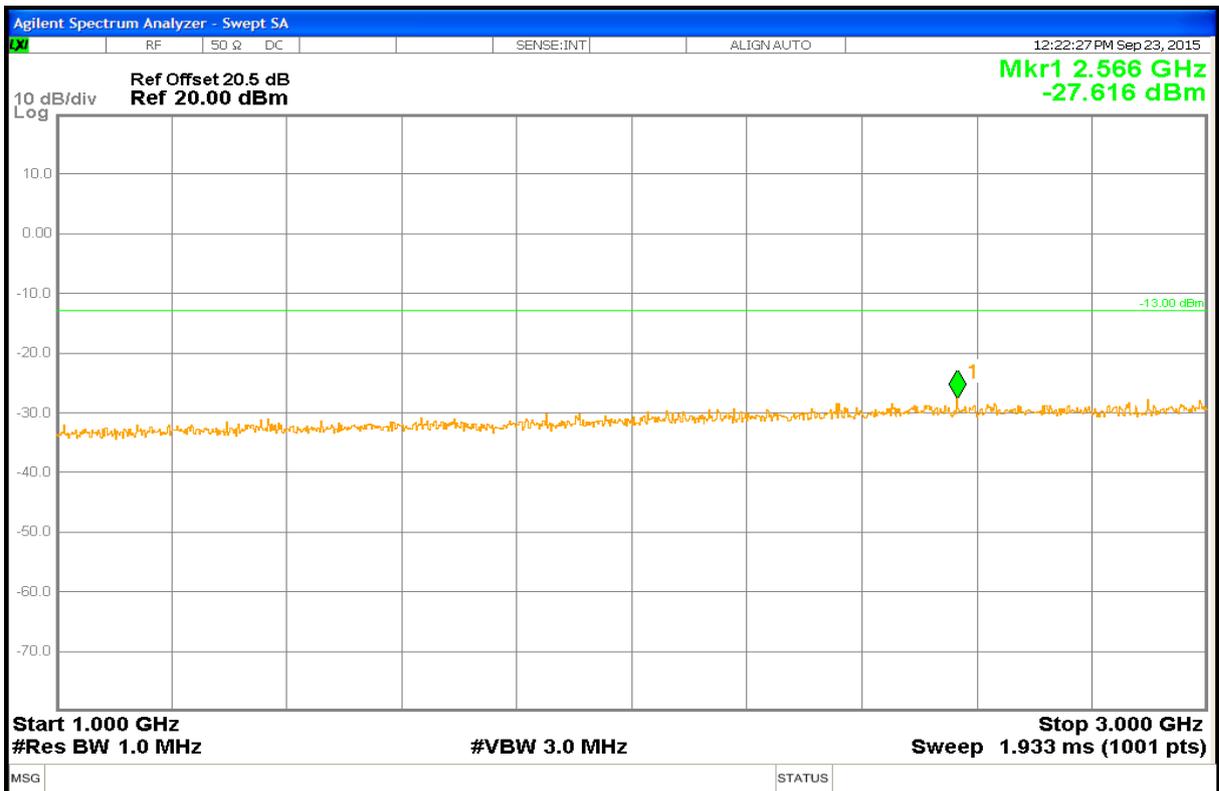
Plot No. 7: 118.000 MHz, 9 kHz – 30 MHz



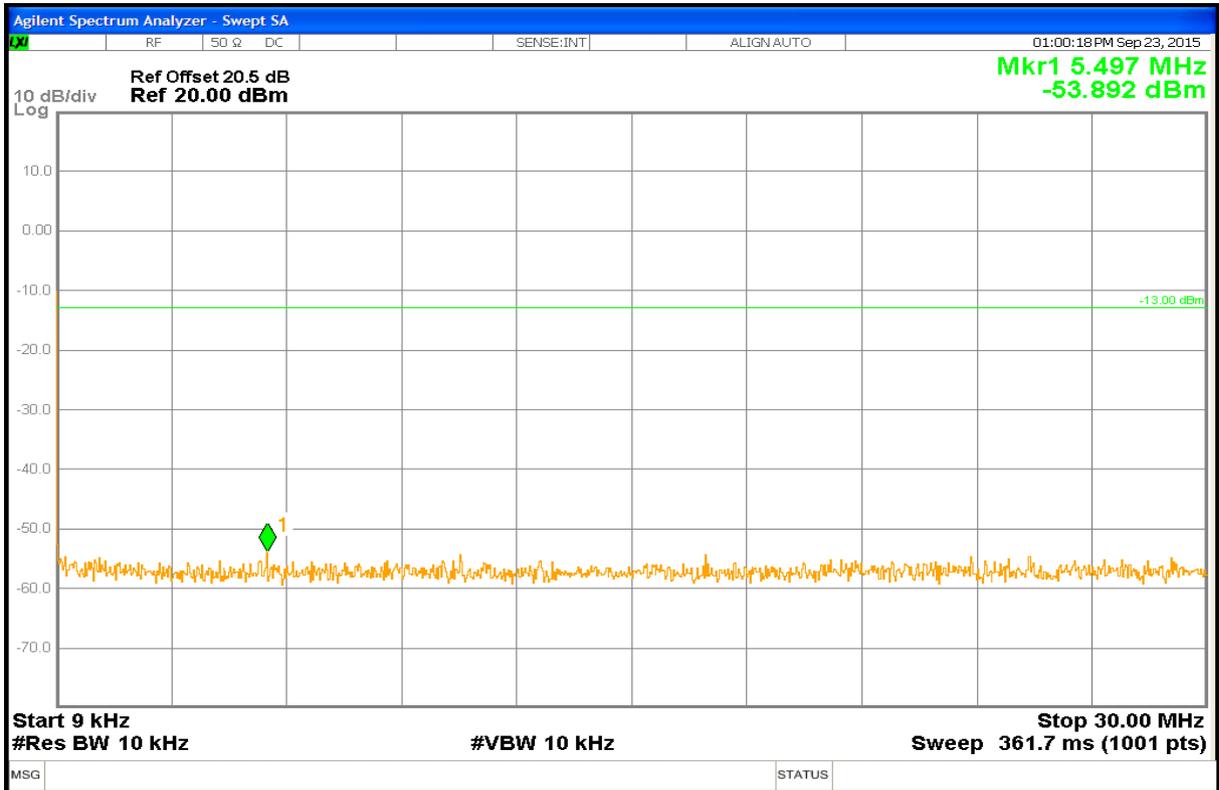
Plot No. 8: 118.000 MHz, 30 MHz – 1 GHz



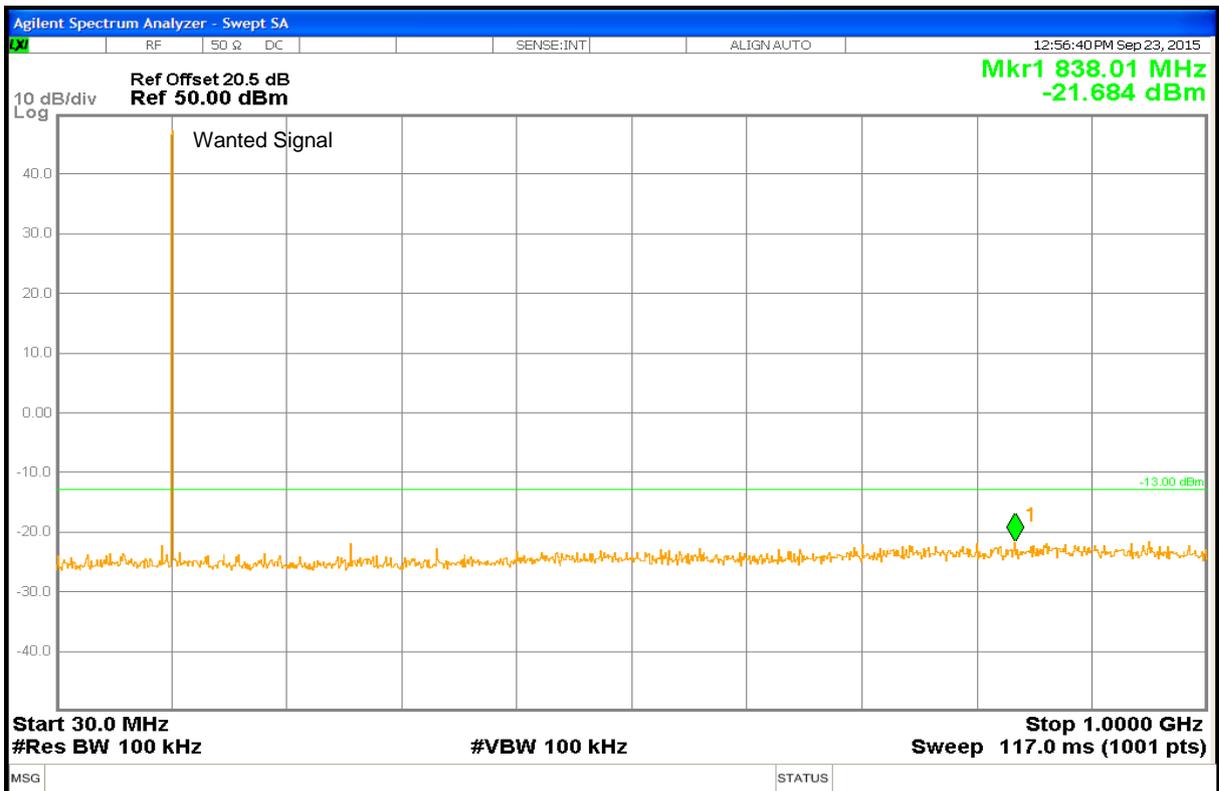
Plot No. 9: 118.000 MHz, 1 GHz – 3 GHz



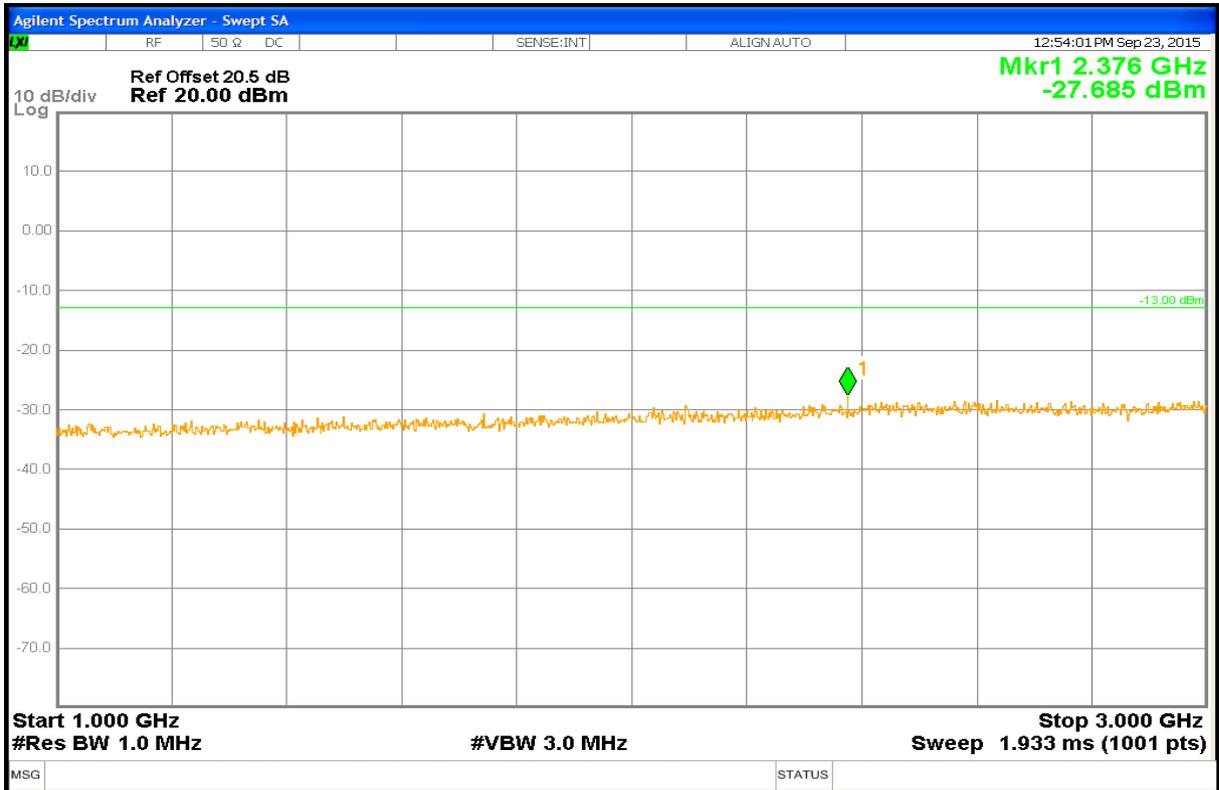
Plot No. 10: 127.500 MHz, 9 kHz – 30 MHz



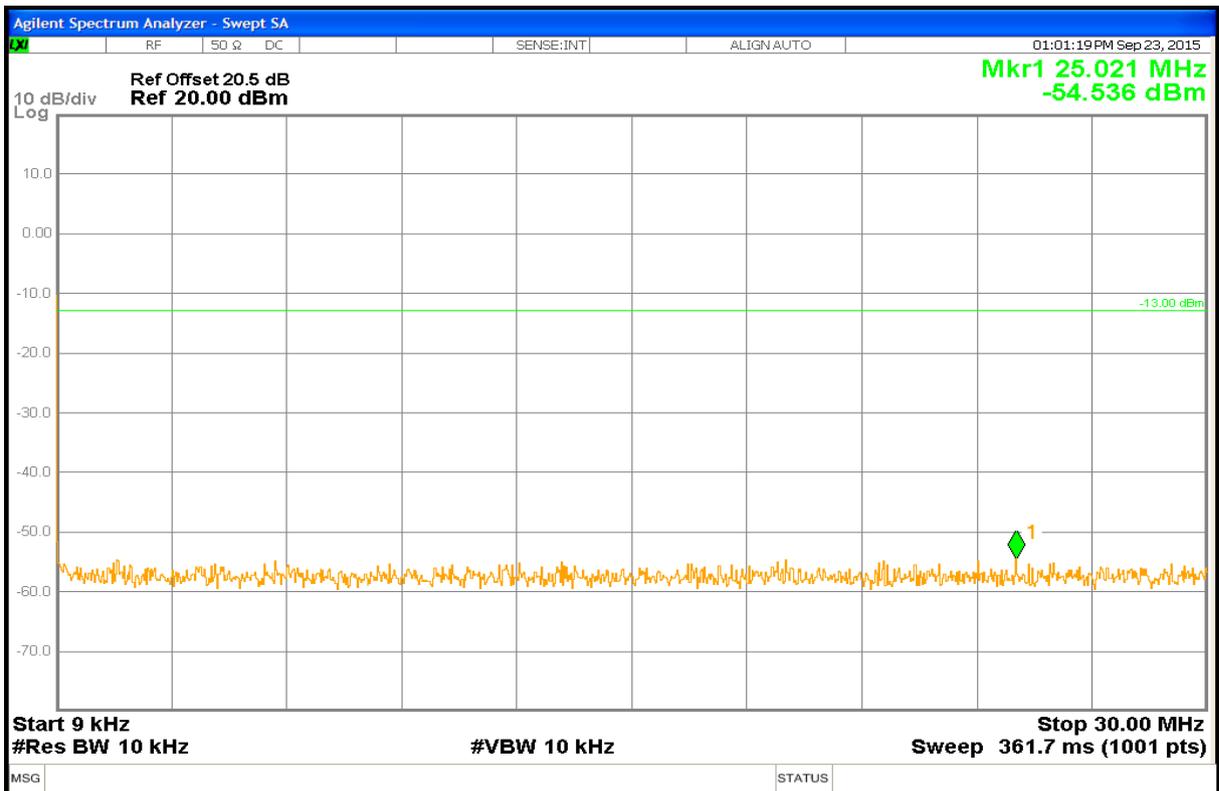
Plot No. 11: 127.500 MHz, 30 MHz – 1 GHz



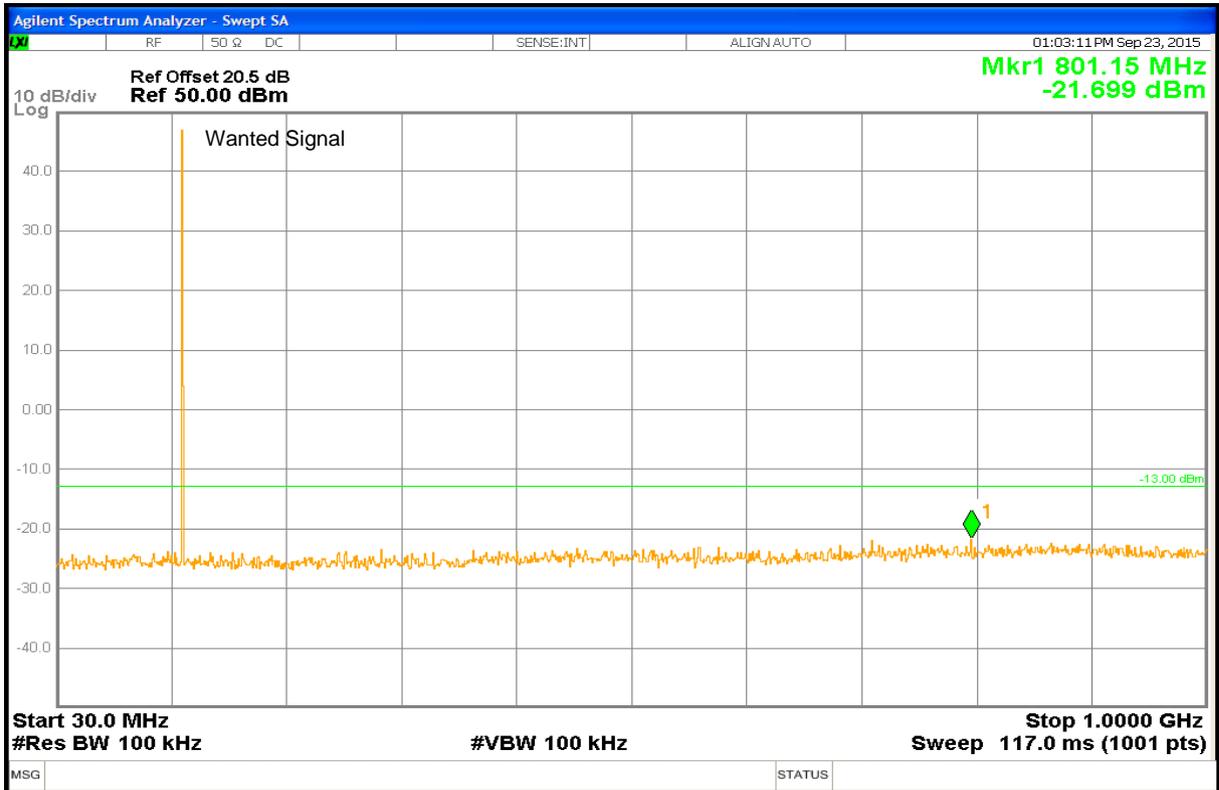
Plot No. 12: 127.500 MHz, 1 GHz – 3 GHz



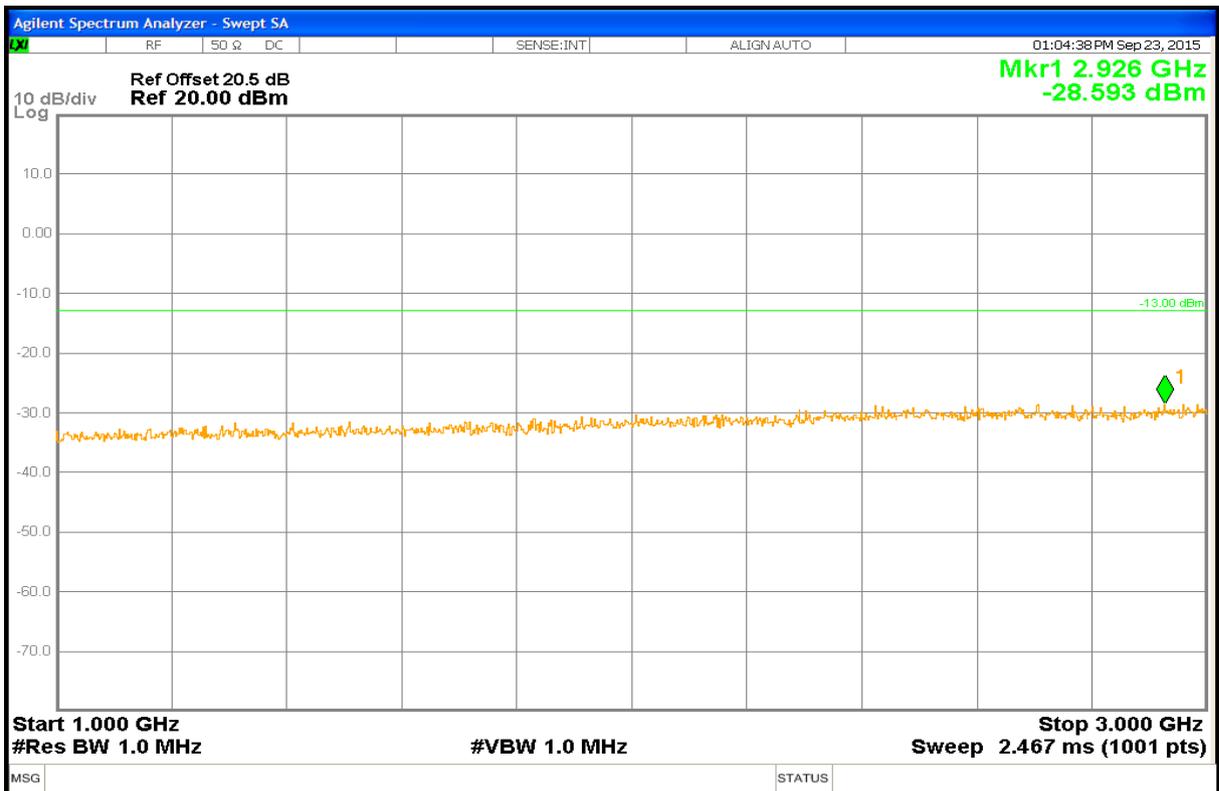
Plot No. 13: 136.975 MHz, 9 kHz – 30 MHz



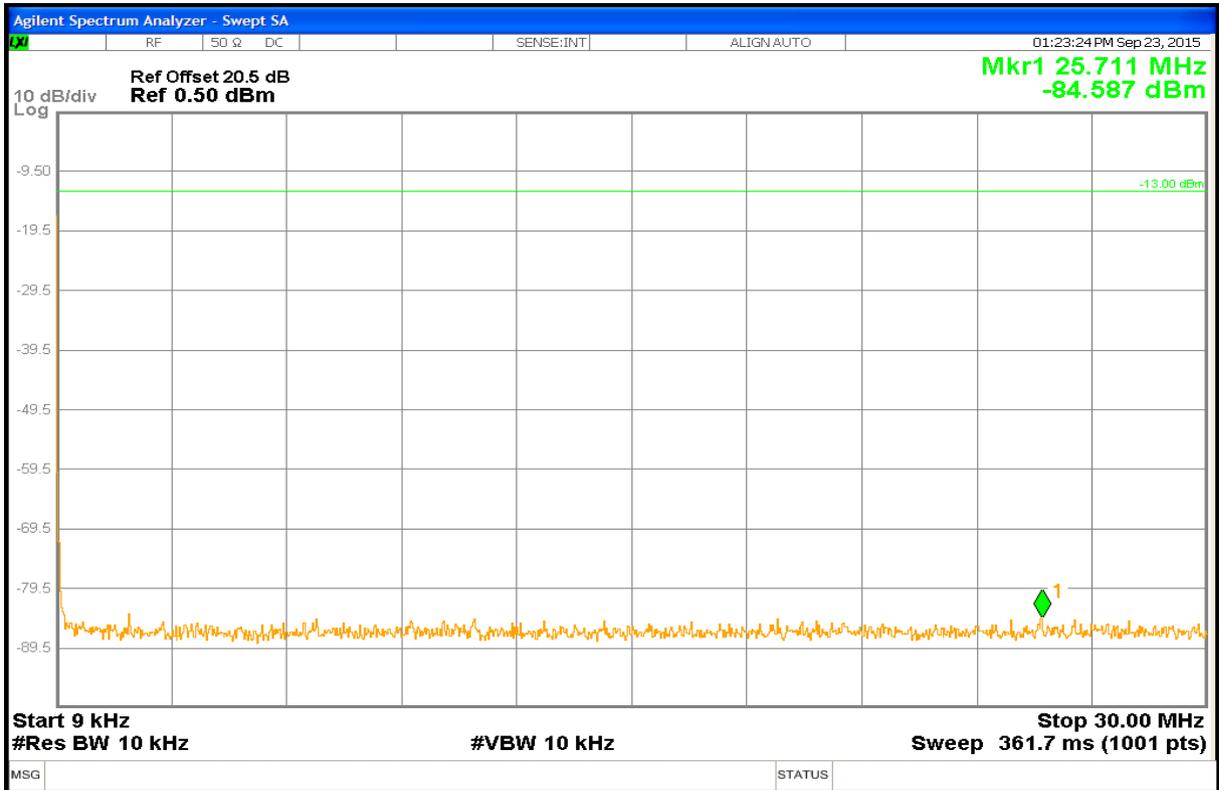
Plot No. 14: 136.975 MHz, 30 MHz – 1 GHz



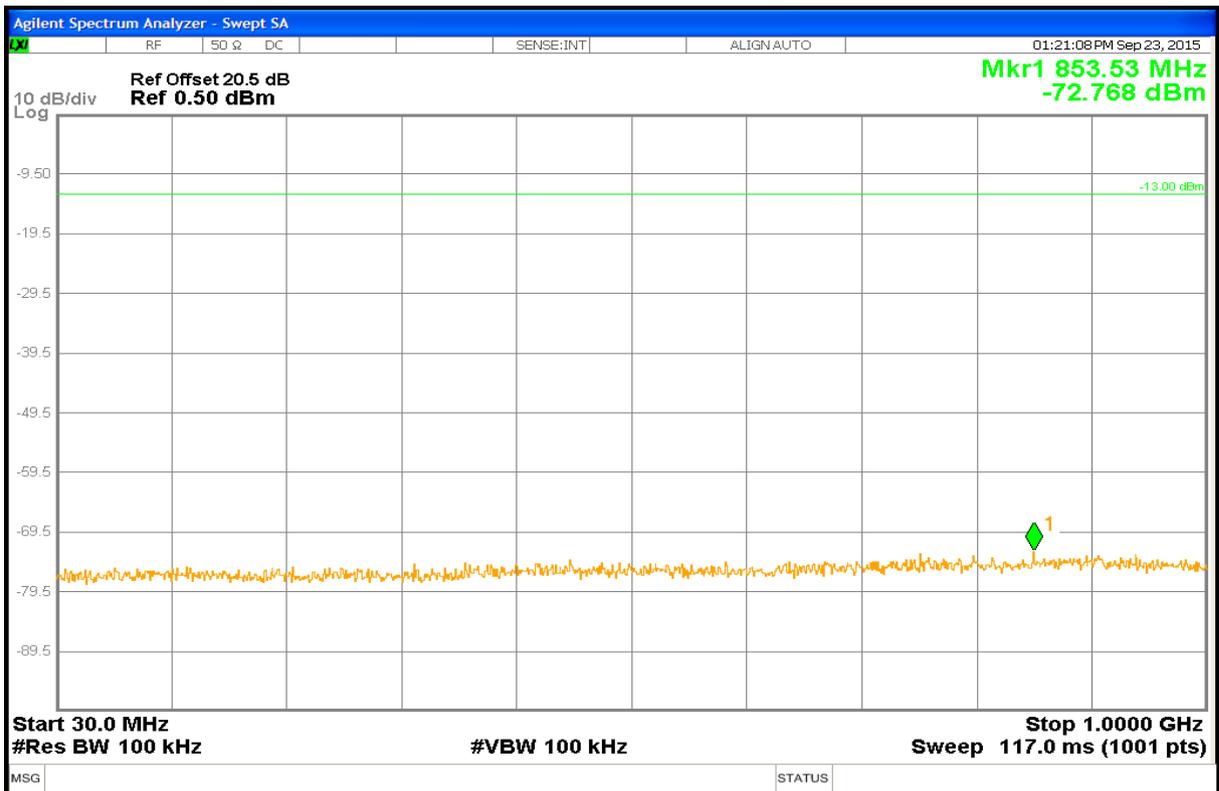
Plot No. 15: 136.975 MHz, 1 GHz – 3 GHz



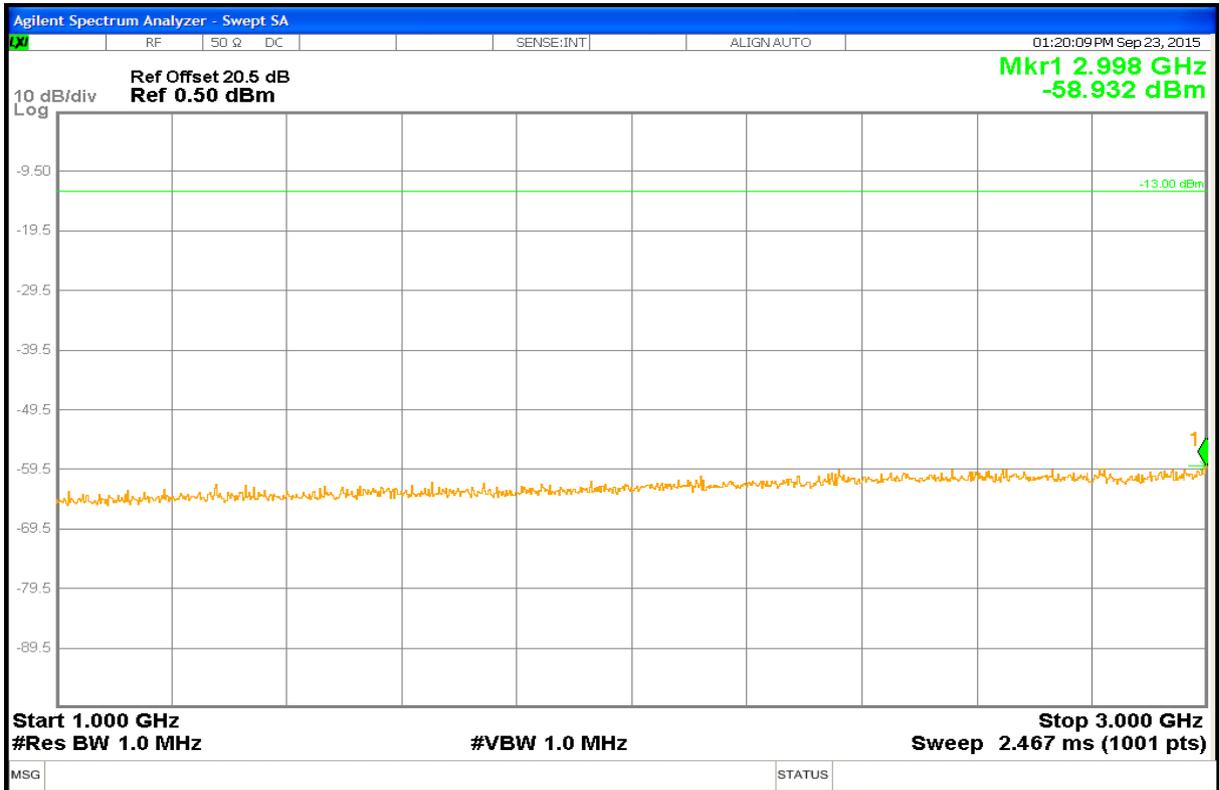
Plot No. 16: RX-Mode, 9 kHz – 30 MHz



Plot No. 17: RX-Mode, 30 MHz – 1 GHz



Plot No. 18: RX-Mode, 1 GHz – 3 GHz



11.6 Field strength of spurious Emissions (radiated) § 2.1053 & § 87.139 (a)

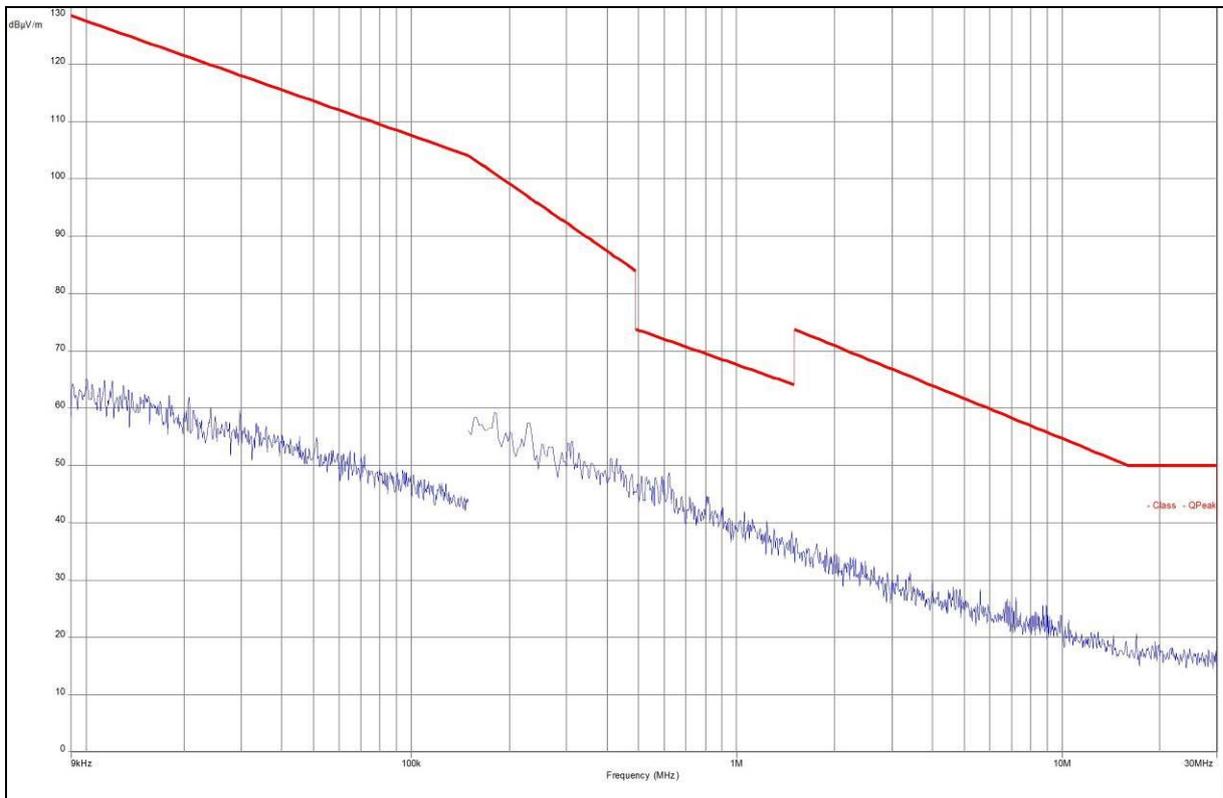
Test conditions:	TX Frequencies	F	=	118.000 - 127.500 - 136.975 MHz
	Power Supply	V nom	=	28.0 V
	Temperature	T nom	=	23.0 °C

FCC	Limit § 2.1051 & 87.139(a):	-13 dBm (TX-Mode)
	30 MHz – 88 MHz:	100 µV/m @ 3 m (RX-Mode)
	88 MHz – 216 MHz:	150 µV/m @ 3 m (RX-Mode)
	216 MHz – 960 MHz:	200 µV/m @ 3 m (RX-Mode)
	Above 960 MHz:	500 µV/m @ 3 m (RX-Mode)

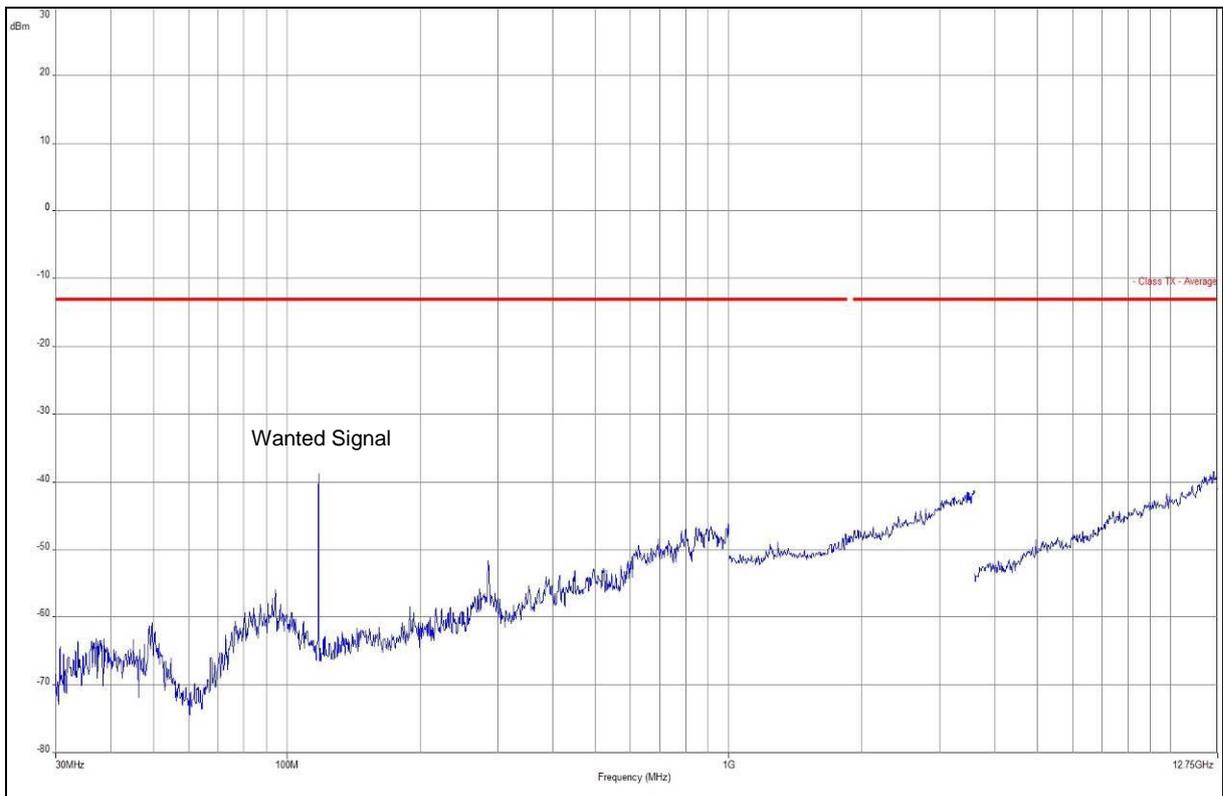
No critical peaks found!

Result: The measurement is passed

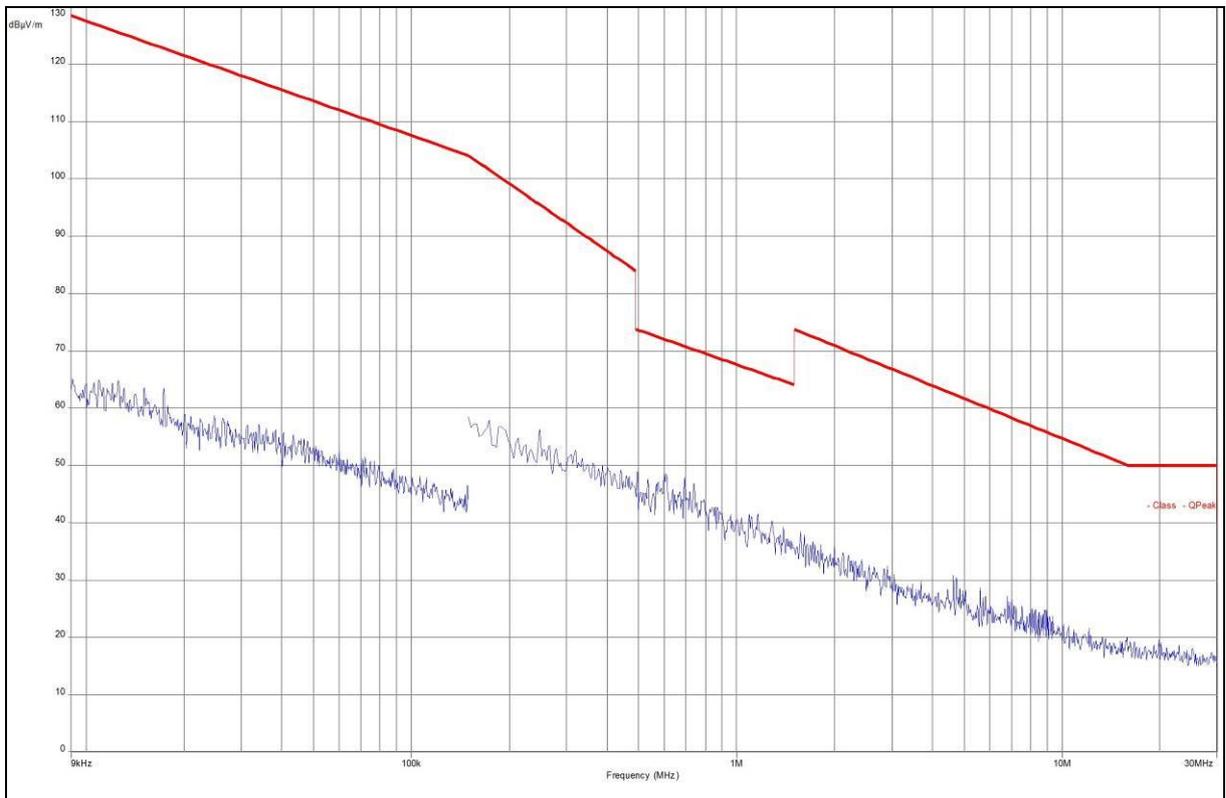
Plot No. 19: 118.000 MHz, 9 kHz – 30 MHz



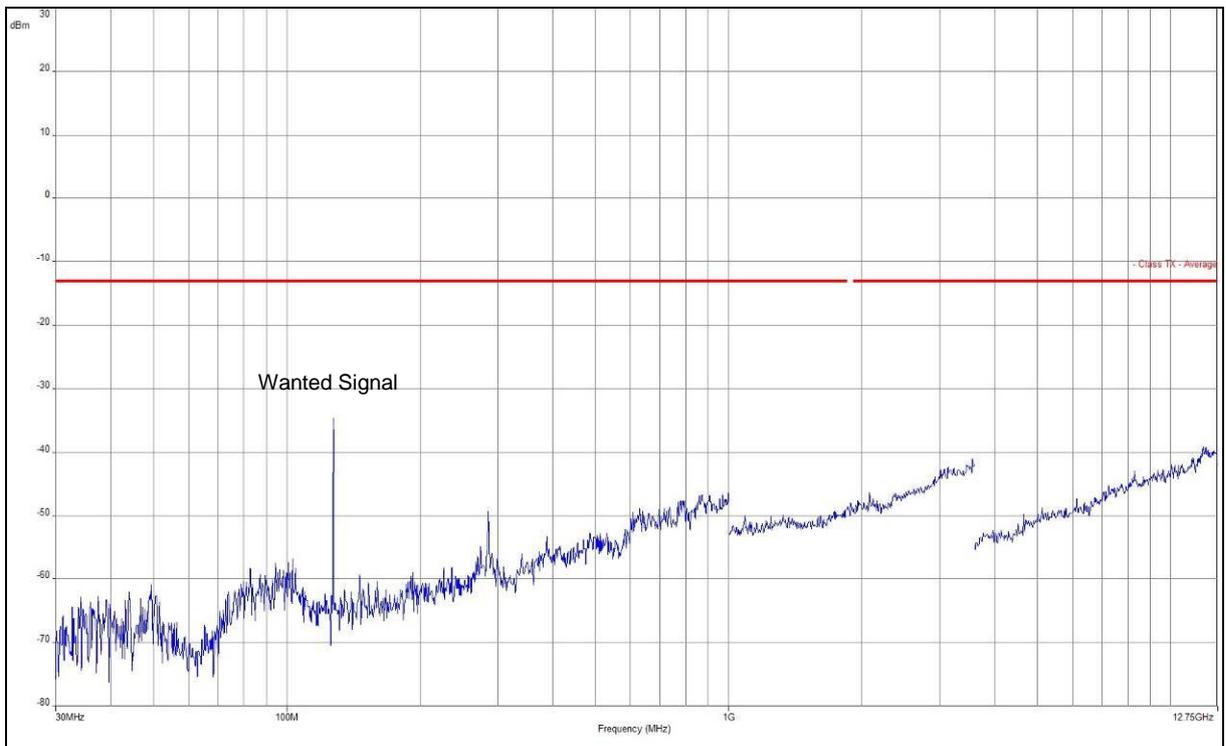
Plot No. 20: 118.000 MHz, 30 MHz – 12.75 GHz



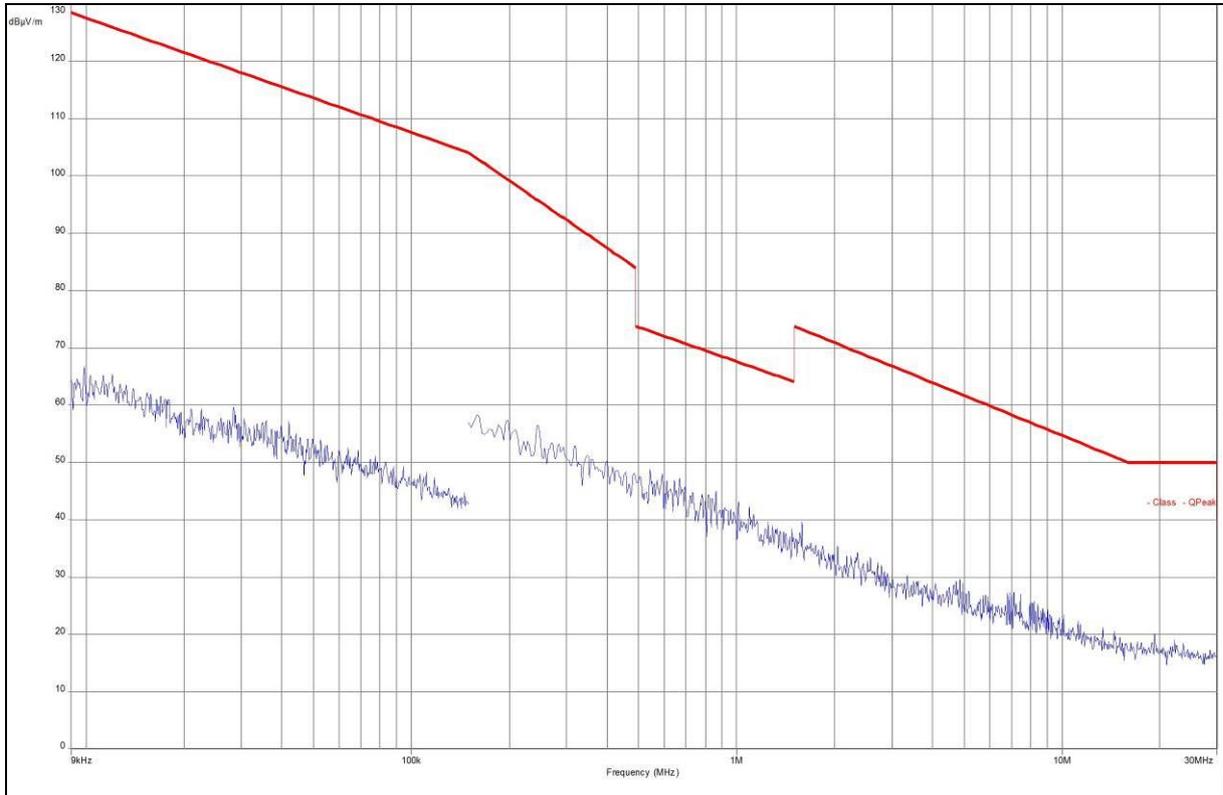
Plot No. 21: 127.500 MHz, 9 kHz – 30 MHz



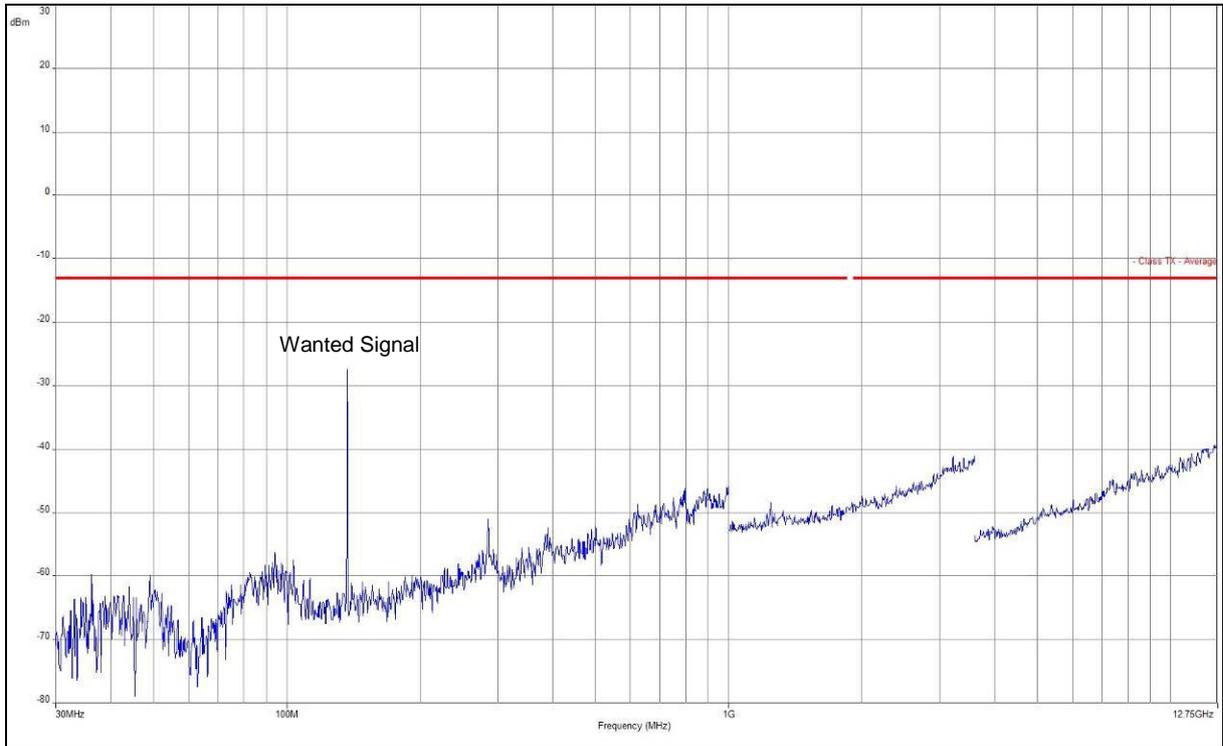
Plot No. 22: 127.500 MHz, 30 MHz – 12.75 GHz



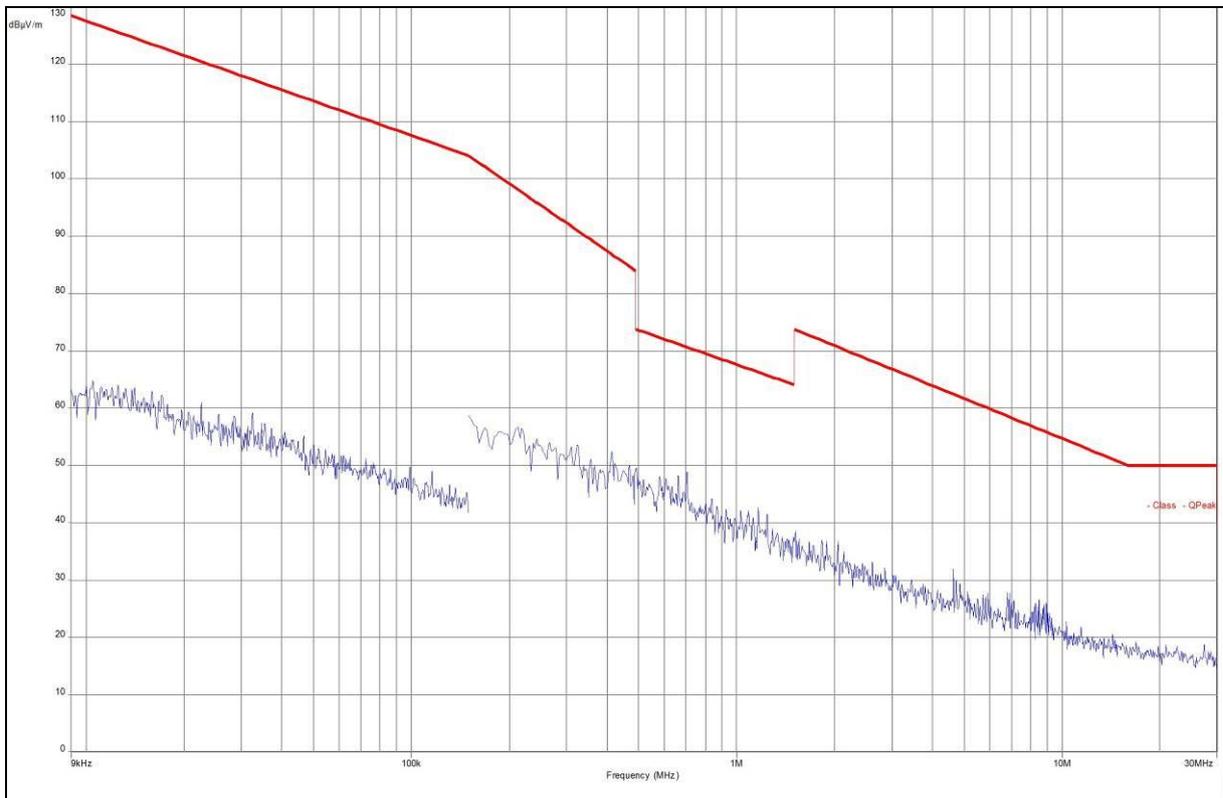
Plot No. 23: 136.975 MHz, 9 kHz – 30 MHz



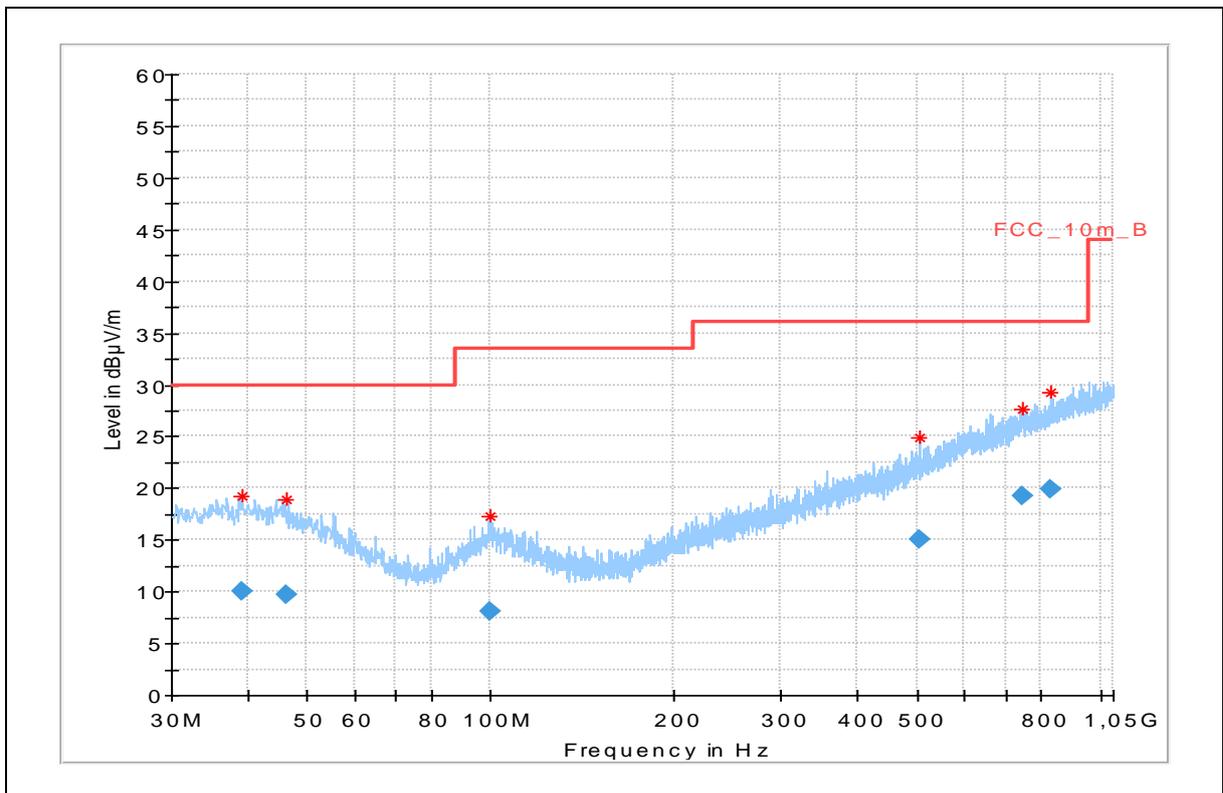
Plot No. 24: 136.975 MHz, 30 MHz – 12.75 GHz



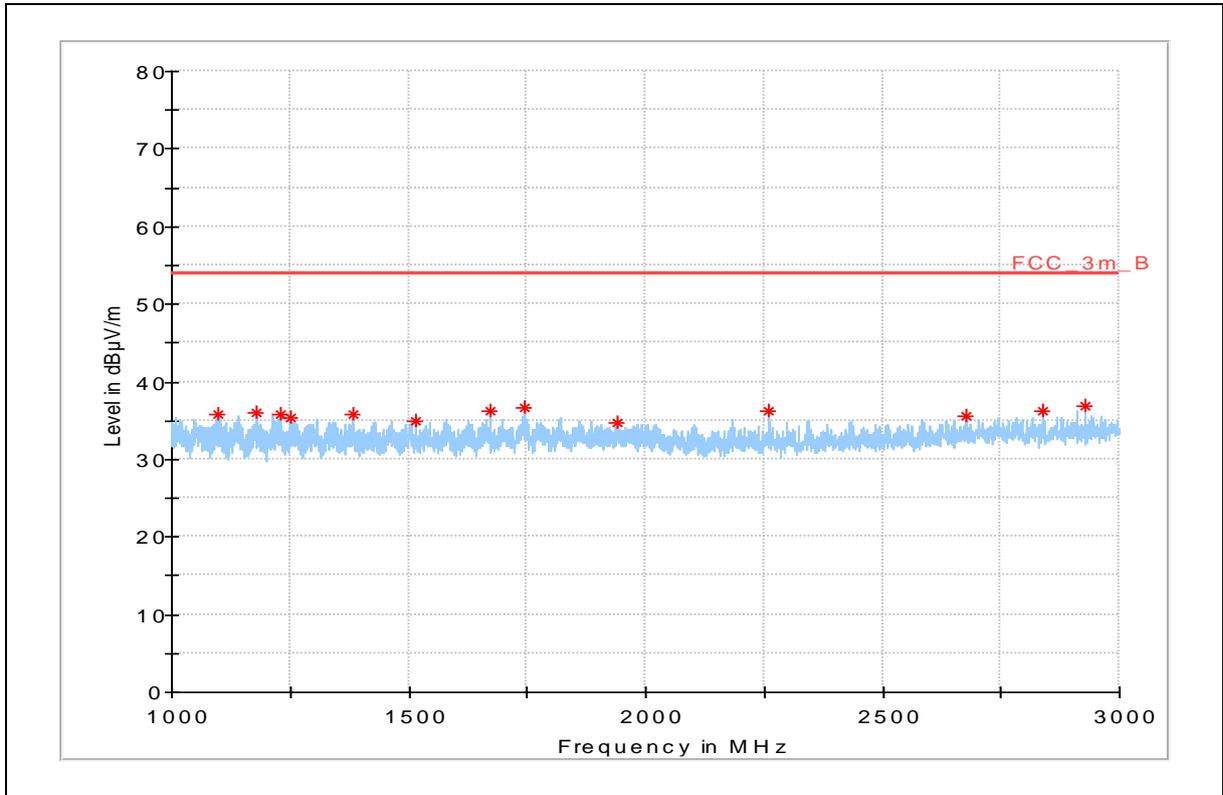
Plot No. 25: RX-Mode, 9 kHz – 30 MHz



Plot No. 26: RX-Mode, 30 MHz – 1 GHz



Plot No. 27: RX-Mode, 1 GHz – 3 GHz



11.7 Frequency Stability § 2.1055 & § 87.133 (5)

Test conditions: TX Frequencies F = 118.000 - 127.500 - 136.975 MHz
 Power Supply V nom = 28.0 V
 V min = 22.0 V
 V max = 30.3 V
 Temperature T nom = 23.0 °C
 T min = -40.0 °C
 T max = 70.0 °C

FCC Limit § 2.1055 & 87.133(5): 20 ppm

Test Result:

T °C	118.000 MHz	127.500 MHz	136.975 MHz
+70	117.999 960	127.499 984	136.974 986
+60	117.999 980	127.499 990	136.974 998
+50	117.999 998	127.500 008	136.975 006
+40	118.000 006	127.500 008	136.975 006
+30	118.000 004	127.500 004	136.975 008
+20	118.000 000	126.500 002	136.975 000
+10	117.999 994	126.499 996	136.974 998
0	117.999 988	126.499 988	136.974 986
-10	117.999 980	127.499 978	136.974 972
-20	118.000 008	127.500 012	136.975 012
-30	118.000 094	127.500 102	136.975 102
-40	118.000 102	127.500 108	136.975 108

Frequency error < 0.2 ppm

Result: The measurement is passed

Annex A Document history

Version	Applied changes	Date of release
DRAFT	Initial release - DRAFT	2016-01-08
1.0	Initial release	2016-01-15
-A	Measurements above 136.975 MHz deleted	2016-02-22

Annex B Further information

Glossary

AVG	-	Average
DUT	-	Device under test
EMC	-	Electromagnetic Compatibility
EN	-	European Standard
EUT	-	Equipment under test
ETSI	-	European Telecommunications Standard Institute
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	Not applicable
PP	-	Positive peak
QP	-	Quasi peak
S/N	-	Serial number
SW	-	Software
PMN		Product marketing name
HMN		Host marketing name
HVIN		Hardware version identification number
FVIN		Firmware version identification number

