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TEST REPORT
No. AR18-0031792-01

performed in accordance with

FCC Rules: Code of Federal Regulations (CFR) no. 47
Part 15 Subpart C Section 15.247

PRODUCT	Bluetooth Low Energy module
MODEL(s) TESTED	BLUENRG-M2SA
FCC ID	S9NBNRGM2SA
TRADE MARK(s)	STMICROELECTRONICS

APPLICANT	STMicroelectronics - Via Olivetti, 2 I-20864 Agrate Brianza (MB)

Tested by	Robertino Torri *[Laboratory technician]*	Torri Robertino Nov 9 2018 9:17 AM
Approved by	Giovanni Di Turi *[Laboratory manager]*	

Revision Sheet

Release No.	Date	Revision Description
Rev. 0	2018-10-26	First edition Digital signed - AR18-0031792-01_TR_FCC 15.247 - STM - BLUENRG-M2SA

1. GENERAL DATA

SAMPLE		
Samples received on	**2018-09-28**	**(Item(s) sampled and sent by applicant)**
IMQ reference samples	**BEM**	**92584**
Samples tested No.	1	
Object under analysis recognition	**Not carried out** Except where stated, characteristics of products were taken from client description and were not verified by the laboratory	
Date of acceptance of test item	2018-10-05	
TEST LOCATION		
Testing dates	2018-10-05 ÷ 2018-10-10	
Testing laboratory.	IMQ S.p.A. - Via Quintiliano, 43 – I-20138 Milano	
Testing site	Via Quintiliano, 43 – I-20138 Milano	
ENVIRONMENTAL CONDITIONING		
Parameter	***Measured***	
Ambient Temperature	24.0 ÷ 24.2 °C	
Relative Humidity	46 ÷ 57 %	
Atmospheric Pressure	1005 ÷ 1007 mbar	
The laboratory is monitored by a continuous environmental conditions measurements system. Temperature, humidity and pressure data are recorded on a weekly basis and stored in local archive.		
REMARKS		
Throughout this report a point is used as the decimal separator. The ability or reliability of this product to perform its intended function in a particular application has not been investigated. Unless otherwise specified, warnings, installation instruction and/or user manual provided with the sample have been checked in Italian or English version only. IMQ declines any responsibility derived from missing or wrong information provided aside by the applicant.		

2. REFERENCE DOCUMENT

DOCUMENT		DATE	TITLE
☒	47 CFR Part 15	2015	Radio Frequency Device
☒	ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
☒	ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

3. UNIT UNDER TEST (EUT) DETAILS

GENERAL DATA

MODEL (basic)	Description
BLUENRG-M2SA	Bluetooth Low Energy module
VARIANTS (derived)	**Description**
/	/

FCC ID	S9NBNRGM2SA

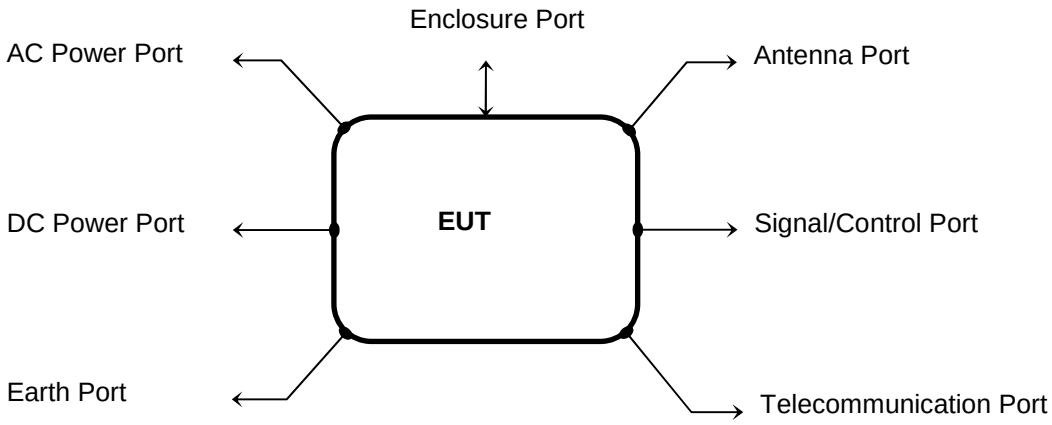
Manufacturer	STMicroelectronics - Via Olivetti, 2 - I-20864 Agrate Brianza (MB)

Type of equipment	DTS - Digital transmission equipment (Bluetooth® Low Energy module)
Operating frequency	2400 ÷ 2483.5 MHz
Max RF radiated power	101.33 dBµV/m @3m
Modulation	GFSK
Channel	40 channel, 2MHz spaced from 2402 to 2480MHz
Antenna	2450AT18A100E of JOHANSON TECHNOLOGY
Remarks	None

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1(lower)	2402	2	2404	3	2406	4	2408
5	2410	6	2412	7	2414	8	2416
9	2418	10	2420	11	2422	12	2424
13	2426	14	2428	15	2430	16	2432
17	2434	18	2436	19	2438	20(middle)	2440
21	2442	22	2444	23	2446	24	2448
25	2450	26	2452	27	2454	28	2456
29	2458	30	2460	31	2462	32	2464
33	2466	34	2468	35	2470	36	2472
37	2474	38	2476	39	2478	40(higher)	2480

4. TEST CONFGURATION OF UNIT UNDER TEST

EUT PORTS



Port	Description	Max length
Enclosure	Open frame board	/
AC power	Power supply of notebook	/
DC power	3.0 V (2 x AAA alkaline battery)	/
Earth	/	/
Telecommunication	/	/
Signal & Control	/	/
Antenna	Dedicated on PCB	/

STATE OF THE EUT DURING TESTS

Ref.	Mode	Description
#1	Operating	The EUT is installed on dedicated USB evaluation board STEVAL-IDB007V1M (battery supplied). The EUT is in continuously transmitting with 100% approximately duty cycle

SUPPORT EQUIPMENT

Defined as equipment needed for correct operation or loading of the EUT, but not considered as tested:

Equipment	Manufacturer	Model
PC with dedicated software for RF transmission management	/	/
Evaluation board	STM	STEVAL-IDB007V1M

ELECTROMAGNETICALLY RELEVANT COMPONENTS

Component	No.	Manufacturer	Model
Bluetooth Low Energy module	1	STMICROELECTRONICS	PC87B V01

RFI SUPPRESSION DEVICES

Component	No.	Manufacturer	Model
/	/	/	/

EMI PROTECTION DEVICES

Component	No.	Manufacturer	Model
/	/	/	/

EUT TECHNICAL DOCUMENTATION

Document	Reference
/	/

5. METHODS OF MEASUREMENT

All compliance measurements have been carried out using the procedures described in the standard ANSI C63.4-2014, ANSI C63.10-2013 and Section 15.31 of CFR47 Part 15 – Subpart A (General). Additional test requirements have been adopted according to the reference Section indicated in the § 6 of this test report.
FREQUENCY RANGE INVESTIGATED
Radiated emission tests: from 9 kHz to tenth harmonic of fundamental.

6. SUMMARY OF TEST RESULTS

POSSIBLE TEST CASE VERDICTS:	
Test object meets the requirement	PASS
Test object does not meet the requirement	FAIL
Test case does not apply to the test object	N.A.
Test not performed	N.P.

CFR47 Part 15	TITLE	RESULT
§ 15.203, § 15.247 (b)(4)(i)	Antenna Requirements	PASS
§ 15.207 (a)	Conducted Emission	PASS
§ 15.209 (a) (f)	Radiated Emission	PASS
§ 15.247 (a)	Frequency Hopping Spread Spectrum Specifications	
§ 15.247(a)	20 dB Bandwidth	N.A.[1]
§ 15.247(a)(1)	Carrier frequency (Hopping Channel) Separation	N.A.[1]
§ 15.247(a)(1)(iii)	Number of Hopping Channels Used	N.A.[1]
§ 15.247(a)(1)(iii)	Channel occupancy time	N.A.[1]
§ 15.247(a)(2)	6dB Minimum Bandwidth	PASS
§ 15.247(b)	Maximum Peak Output Power	
§ 15.247(b) (1)	Peak Output Power	N.A.
§ 15.247(b) (3)	RF power output, radiated (EIRP)	PASS
§ 15.247(b) (4)	Antenna gain	N.A.
§ 15.247(c)	Operation with directional antenna gains greater than 6 dBi	N.A.
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edges	PASS
§ 15.247 (d)	Radiated Emission	PASS
§ 15.247 (e)	Power Spectral Density	PASS
§ 15.247 (f)	Hybrid systems	N.A.[1]
§ 15.247 (g)	FHSS Transmission characteristics	N.A.[1]
§ 15.247 (h)	Recognition of occupied channel and multiple transmission	N.A.[1]
§ 15.247(i), § 47CFR 1.1307(b)(1)	RF humane exposure	PASS

Note 1	Not applicable for DTS equipment

7. TEST RESULTS

7.1 ANTENNA REQUIREMENTS

TEST REQUIREMENT	
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 so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.	
Testing dates	2018-10-05

Antenna specifications	
N° of authorized antenna types	/
Antenna type	Dedicated on PCB
Maximum total gain	+0.5 dBi max peak
External power amplifiers	Not present

TEST RESULT
The EUT meets the requirements of section 15.203 and 15.204

7.2 AC MAINS POWER SUPPLY CONDUCTED EMISSION

TEST REQUIREMENT	
Test setup	ANSI C63.4
Test facility	Shielded chamber
Frequency range	150 kHz – 30 MHz
IF bandwidth	9 kHz
EMC class	B
EUT operating condition	#1
Testing dates	2018-10-05

LIMITS

Band of operations	Quasi-Peak (dBµV)	Average Limit (dBµV)
0.15 ÷ 0.5	66 ÷ 56	56 ÷ 46
0.5 ÷ 5	56	46
5 ÷ 30	60	50

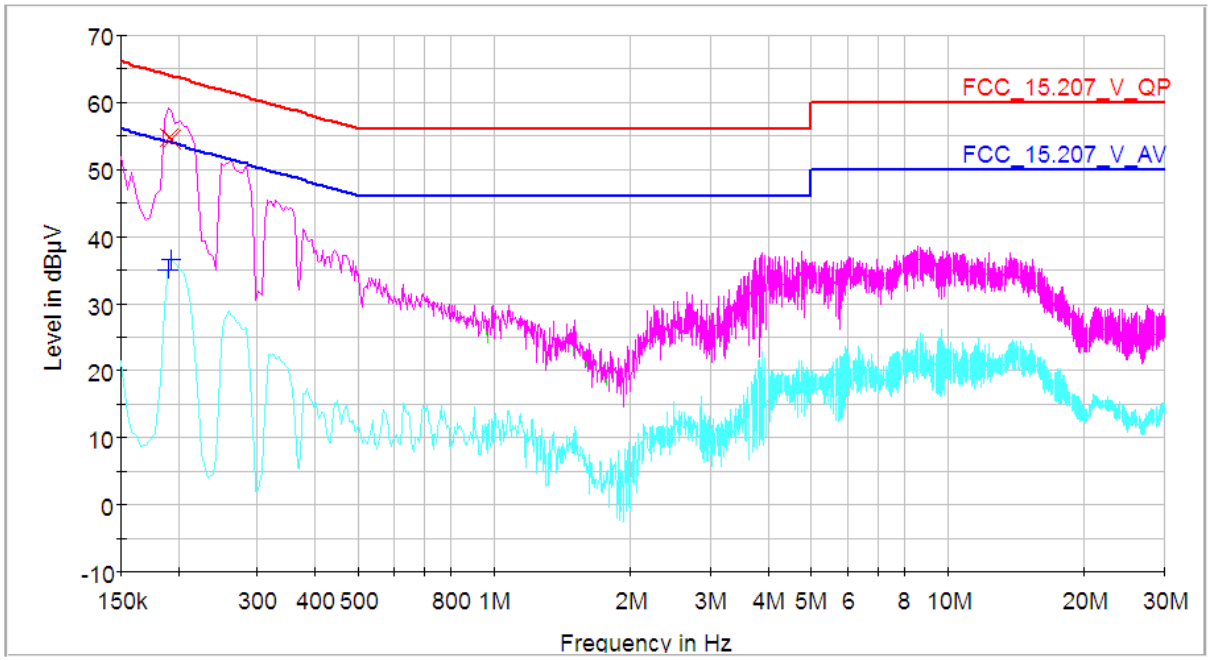
TEST RESULT

The EUT meets the requirements of sections 15.207 (a).

TEST PROCEDURE

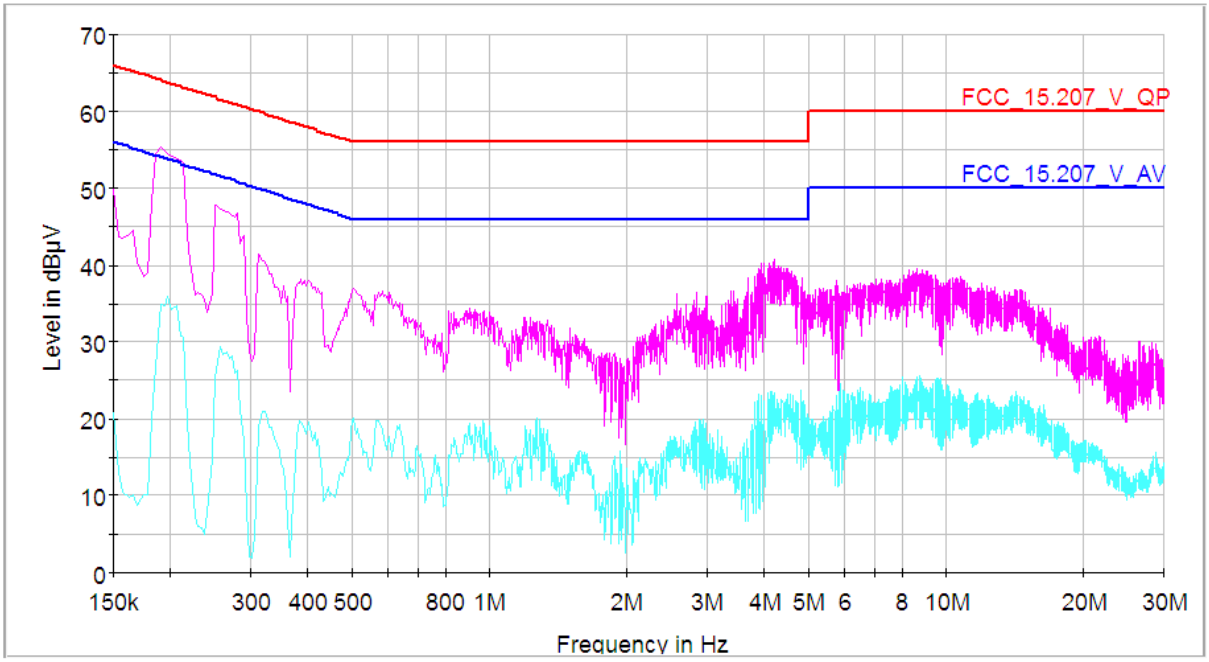
1) The EUT was placed on a wooden table of size, 80 cm by 80 cm, raised 80 cm in which is located 40 cm away from the vertical wall the shielded room.
2) Each EUT power cord input cord was individually connected through a 50Ω/50µH LISN to the input power source.
3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 9 kHz during the measurements.
6) The measurements with Quasi-Peak detector are performed only for frequencies for which the Peak values are ≥ (Q.P. limit - 6 dB).

Conducted disturbance on AC mains worst case measurement result – LOWER CHANNEL

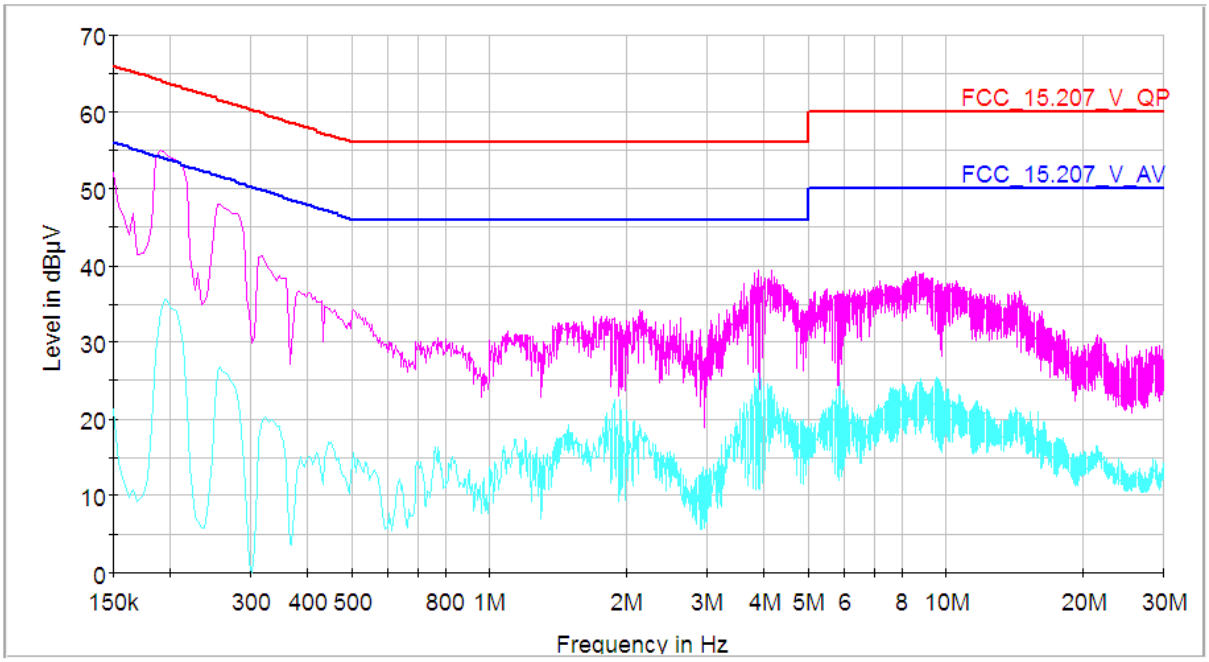


Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)
0.190000	54.6	35.0
0.194000	54.4	36.6

Conducted disturbance on AC mains worst case measurement result – MIDDLE CHANNEL



Conducted disturbance on AC mains worst case measurement result – HIGHER CHANNEL



7.3 RADIATED DISTURBANCES

TEST REQUIREMENT	
Test setup	ANSI C63.4
Test facility	Semi-anechoic chamber
Test distance	3 meters
Frequency range	9 kHz to tenth harmonic of fundamental
IF bandwidth (below 30 MHz)	9 kHz
IF bandwidth (below 1,000 MHz)	120 kHz
IF bandwidth (above 1,000 MHz)	1 MHz
EMC class	B
EUT operating condition	#1
Remark: In accordance with part 15.31 (f) (2), where the measurement distance was specified to be 30 or 300 meters, a correction factor was applied in order to permit measurement to be performed at a separation distance. The applied formula for limits at 3 meter is: Extrapolation (dB) = 40log (300meter / 3meter) = +80db Extrapolation (dB) = 40log (30meter / 3meter) = +40db	
Testing dates	2018-10-05 ÷ 2018-10-10

LIMITS		
Band of operations	**Peak (dBµV/m)**	**Average Limit (dBµV/m)**
Restricted bands (§ 15.205)	74	54
Other bands	According to 15.209 or fundamental –20dB (which is greater)	According to 15.209 or fundamental –20dB (which is greater)

TEST PROCEDURE

1) The EUT was placed on turntable which is 0.8 m above the ground plane
2) The turntable shall rotate from 0° to 360° degrees to determine the position of maximum emission level.
3) The EUT is positioned 3 m away from the receiving antenna which varied from 1 to 4 m to find the highest emission.
4) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 100 kHz below 1000 MHz and 1 MHz above 1000 MHz.
5) The receiving antenna was positioned in both horizontal and vertical polarization.
6) The measurements with Quasi-Peak detector, below 1000 MHz are performed only for frequencies for which the Peak values are ≥ (Q.P. limit - 6 dB).

TEST RESULT

The EUT has been tested in 3 orthogonal axes at the frequencies lowest, middle and highest for each modulation.
The results reported are worst case.
The measurement of spurious emission of EUT in receiver mode is deemed to be fulfilled as no limits are exceeded in transmitter mode (condition considered more burdensome).
The EUT meets the requirements of sections 15.205 (b), 15.209 and 15.247.

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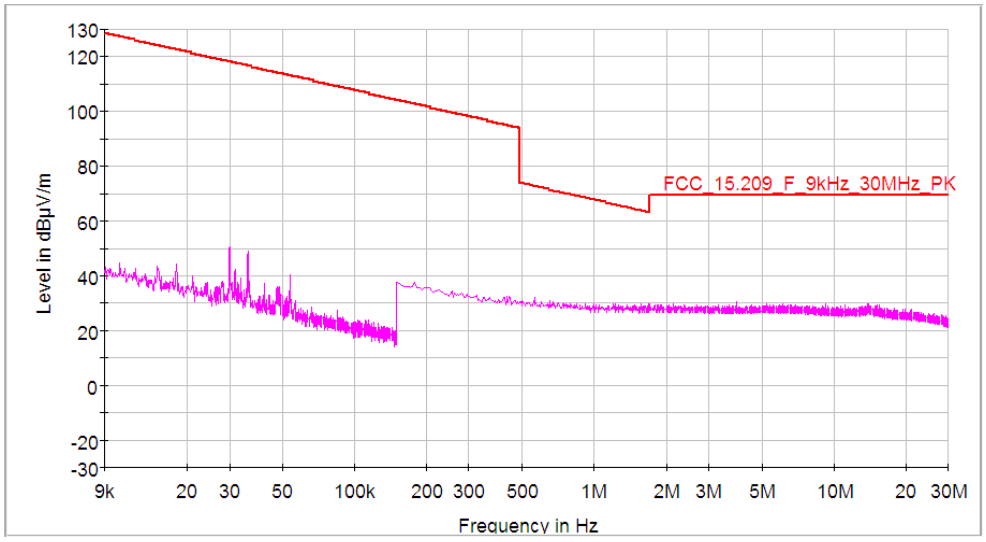
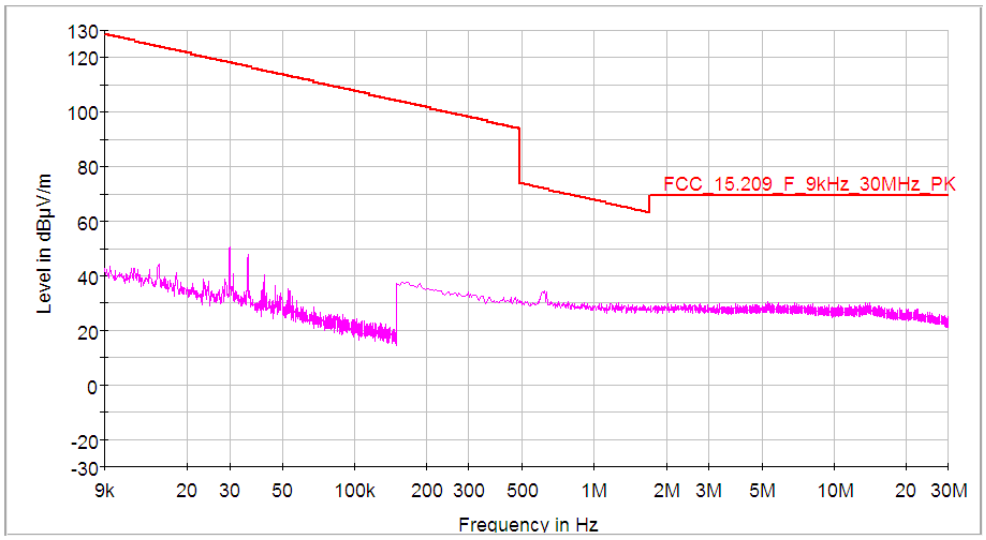
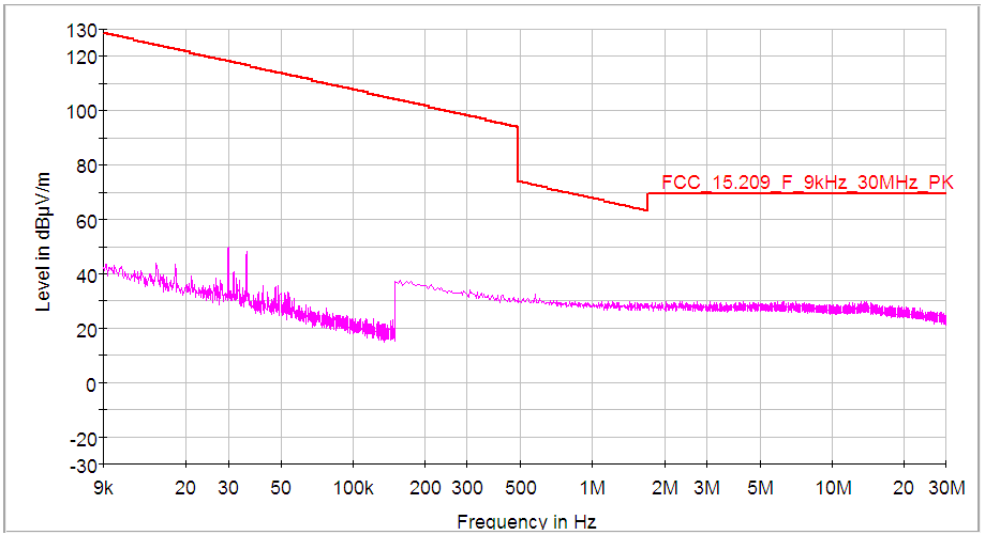
Worst case measurement result 9 kHz÷30 MHz	
LOWER CHANNEL	
MIDDLE CHANNEL	
HIGHER CHANNEL	

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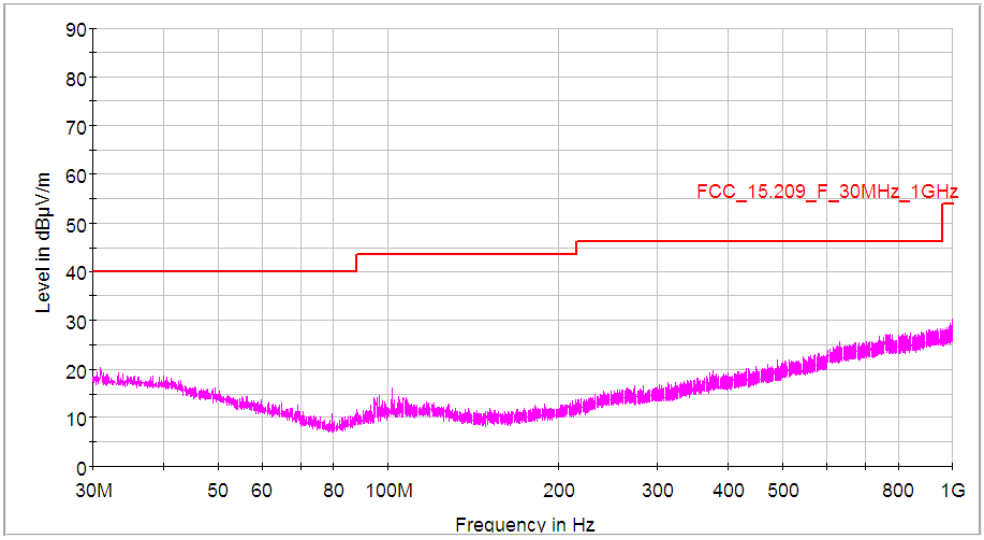
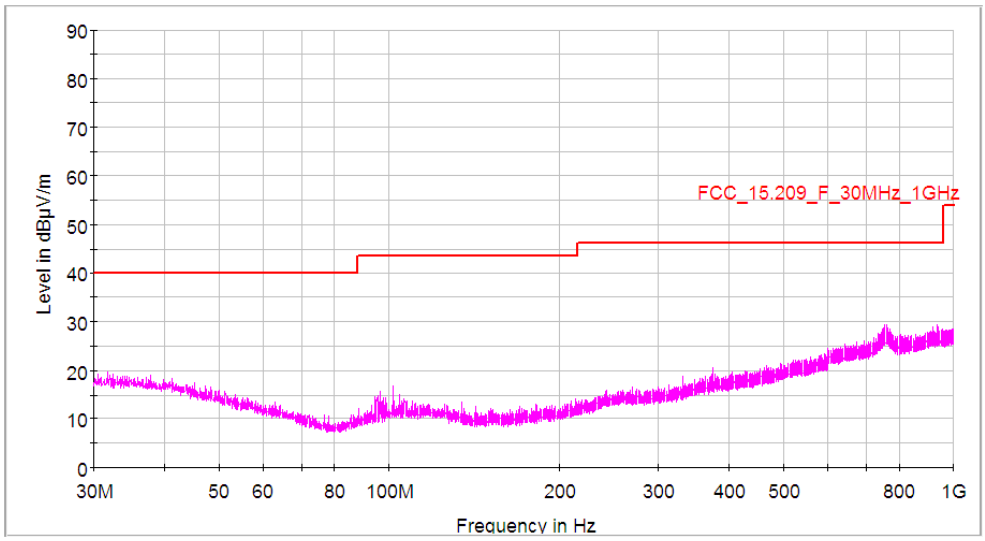
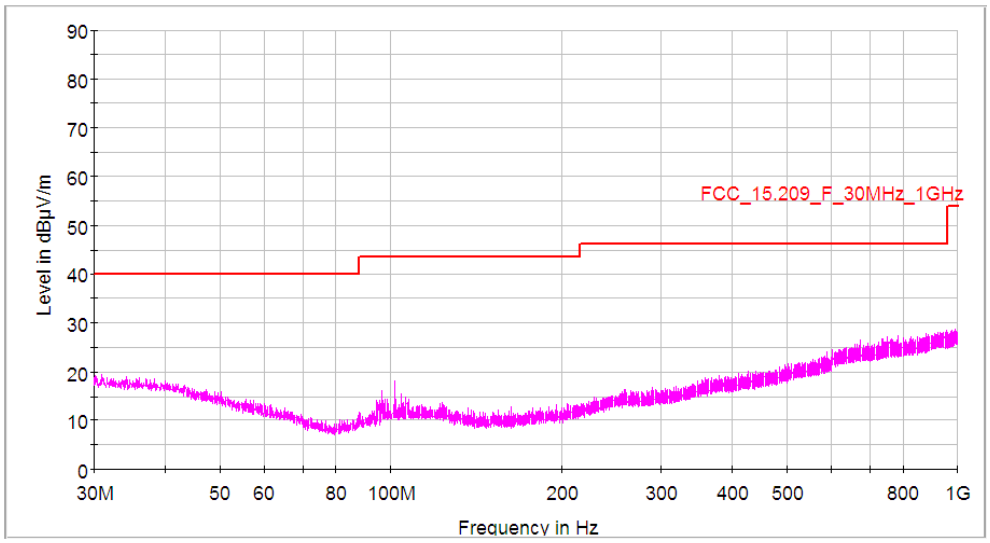
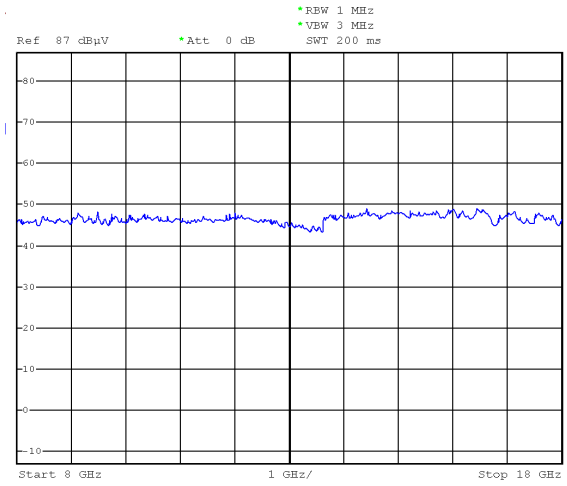
Worst case measurement result 30÷1,000 MHz	
LOWER CHANNEL	
MIDDLE CHANNEL	
HIGHER CHANNEL	

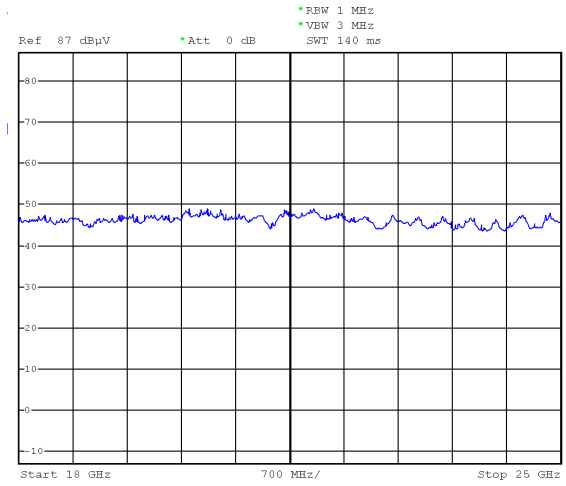
Worst case measurement result >1,000 MHz -

PEAK RESULT (RBW=1MHz; VBW=3MHz)								
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correct reading	PK Limit (AV + 20dB)		Margin
(MHz)	(dBµV)	(dB@3m)	(dB)	(dB)	(dBµV/m)	(µV/m)	(dBµV/m)	(dB)
2402 (lower channel)	94.28	27.30	5.18	-37.57	99.37	---	---	
4804	55.23	31.30	7.31	-36.98	53.60	5000	74	20.40
7206	69.02	36.00	9.09	-37.00	60.93	5000	74	13.07
12010	70.80	38.10	10.71	-37.17	59.16	5000	74	14.84
f>12010	No significant values were found (see plot below)					5000	74	---
2440 (middle channel)	95.35	27.30	5.18	-37.57	100.44	---	---	
4880	56.38	31.45	7.34	-36.90	54.49	5000	74	19.51
9760	71.23	38.20	10.61	-37.15	59.57	5000	74	14.43
12200	76.48	39.10	12.17	-36.00	61.21	5000	74	12.79
f>12200	No significant values were found (see plot below)					5000	74	---
2480 (higher channel)	93.76	27.40	5.18	-37.57	98.75	---	---	
4960	54.23	31.50	7.34	-36.90	52.29	5000	74	21.71
7440	67.99	36.40	9.42	-36.90	59.07	5000	74	14.93
9920	70.63	38.40	10.69	-37.10	58.64	5000	74	15.36
12400	77.40	38.90	12.32	-35.70	61.88	5000	74	12.12
f>7440	No significant values were found (see plot below)					5000	74	---

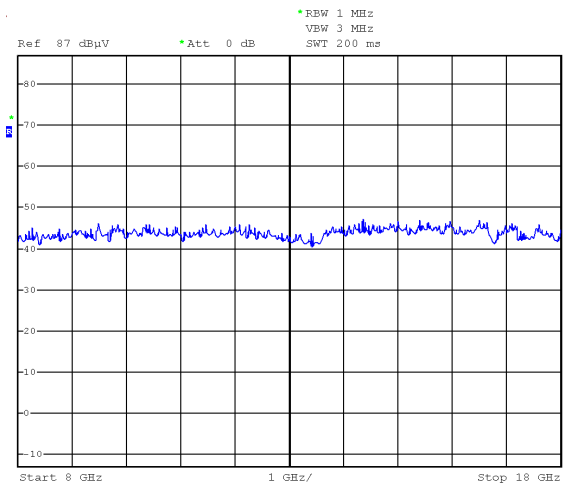
MEASUREMENTS RESULTS >1 GHz

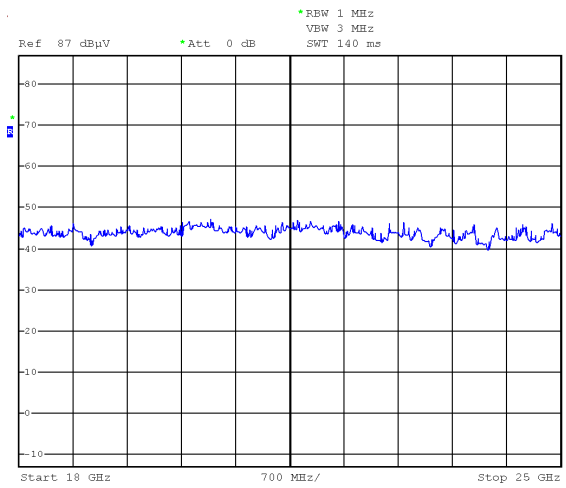
Lower channel (worst case detected)



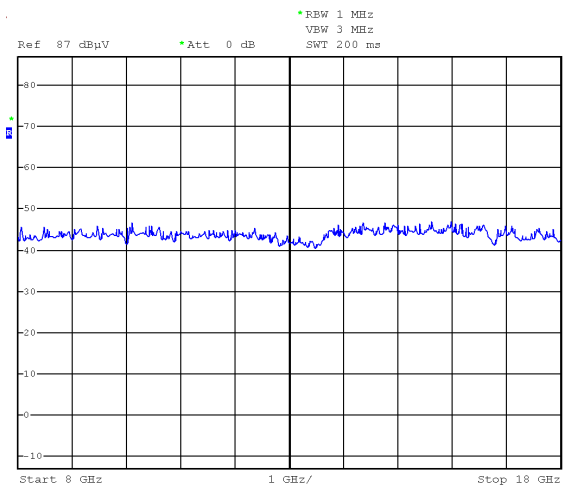


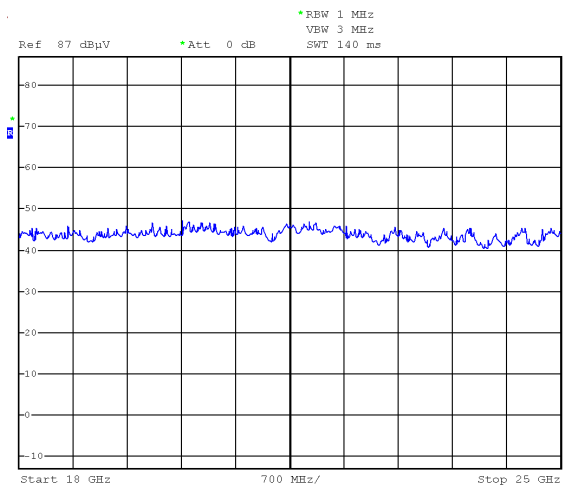
Middle Channel (worst case detected)





Higher channel (worst case detected)

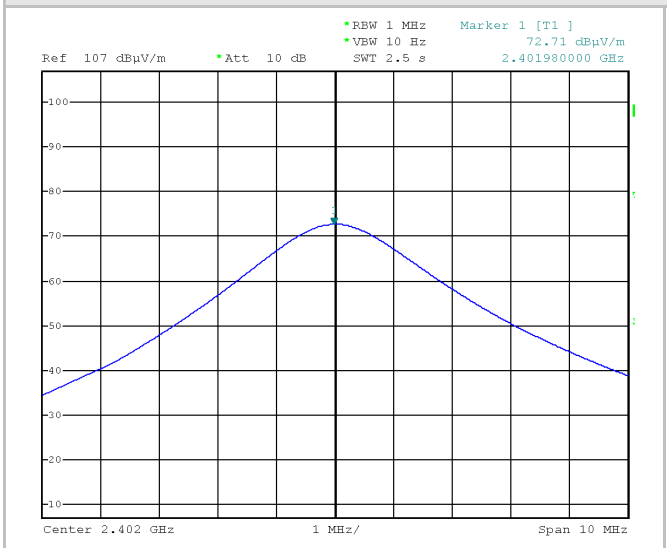


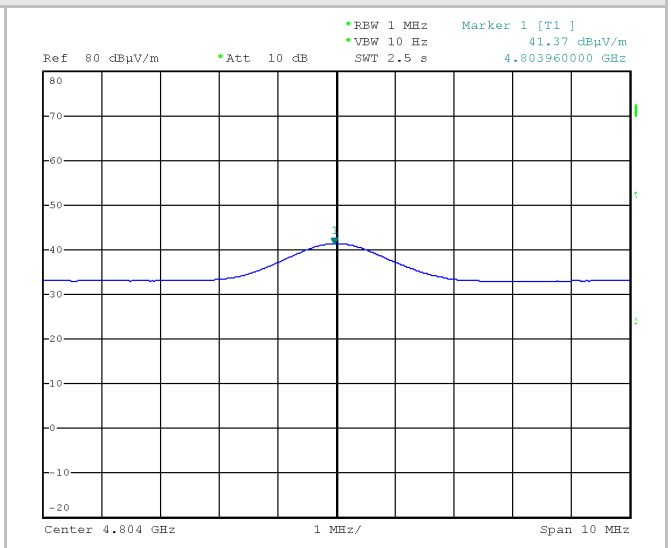


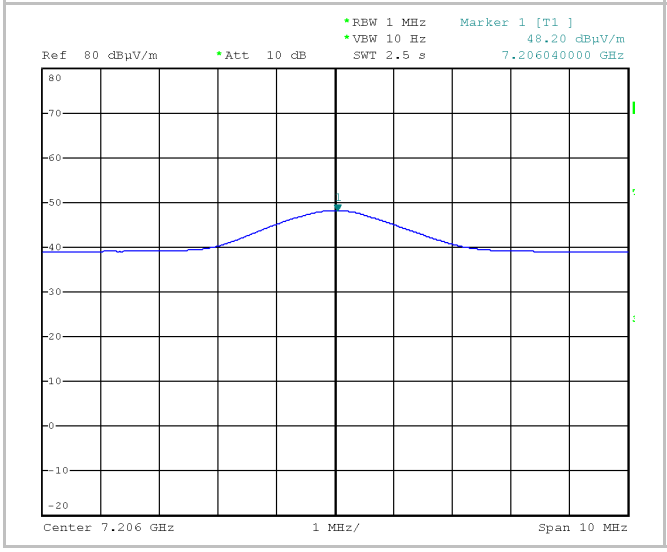
AVERAGE RESULT (RBW=1MHz; VBW=10Hz)								
Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correct reading	AV Limit		Margin
(MHz)	(dBµV)	(dB@3m)	(dB)	(dB)	(dBµV/m)	(µV/m)	(dBµV/m)	(dB)
2402 (lower channel)	67.62	27.30	5.18	-37.57	72.71	---	---	
4804	43.00	31.30	7.31	-36.98	41.37	500	54	12.63
7206	56.29	36.00	9.09	-37.00	48.20	500	54	5.80
9608	57.10	38.10	10.71	-37.17	45.46	500	54	8.54
f>9608	No significant values were found					500	54	---
2440 (middle channel)	68.27	27.30	5.18	-37.57	73.36	---	---	
4880	45.16	31.45	7.34	-36.90	43.27	500	54	10.73
9760	56.23	38.20	10.61	-37.15	44.57	500	54	9.43
f>9760	No significant values were found					500	54	---
2480 (higher channel)	67.06	27.40	5.18	-37.57	72.05	---	---	
4960	43.12	31.50	7.34	-36.90	41.18	500	54	12.82
7440	55.24	36.40	9.42	-36.90	46.32	500	54	7.68
9920	56.36	38.40	10.69	-37.10	44.37	500	54	9.63
f>9920	No significant values were found					500	54	---

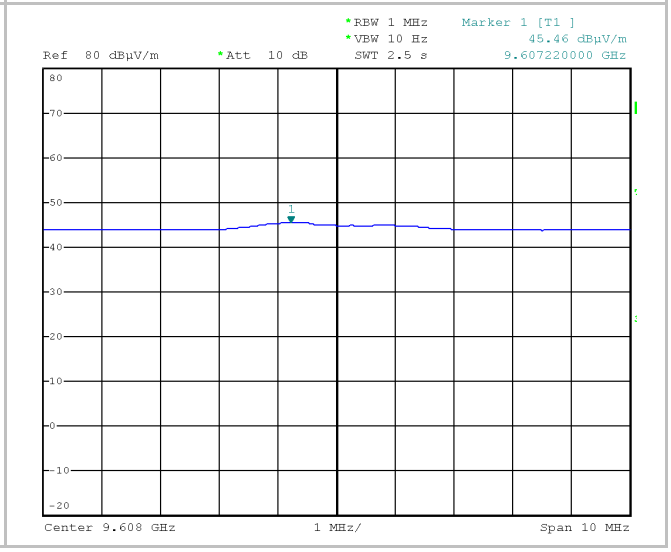
MEASUREMENTS RESULTS <10 GHz

Lower channel (worst case detected)

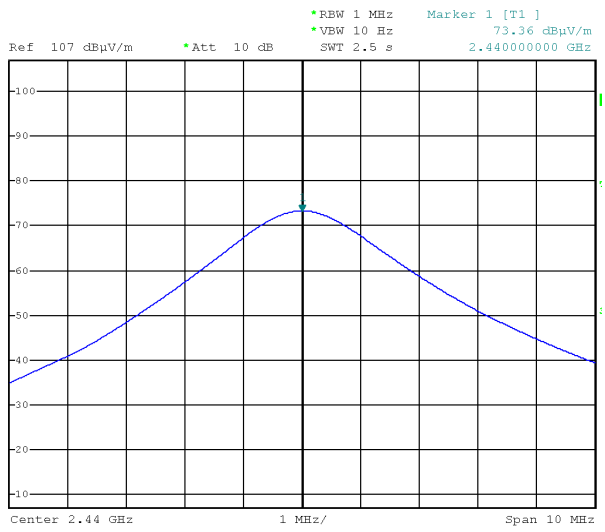


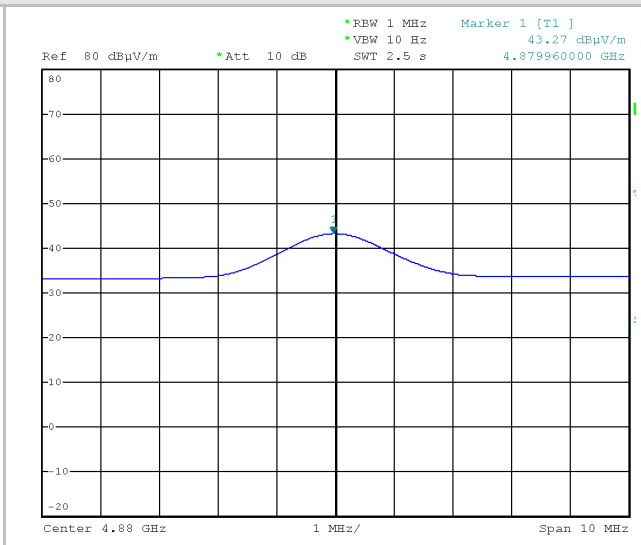


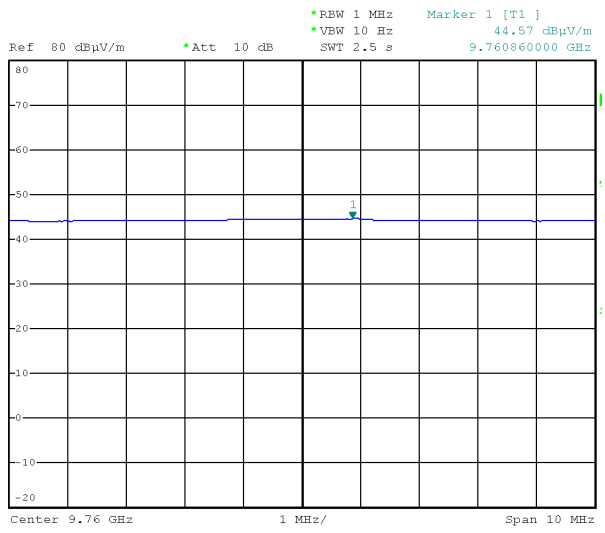




Middle Channel (worst case detected)







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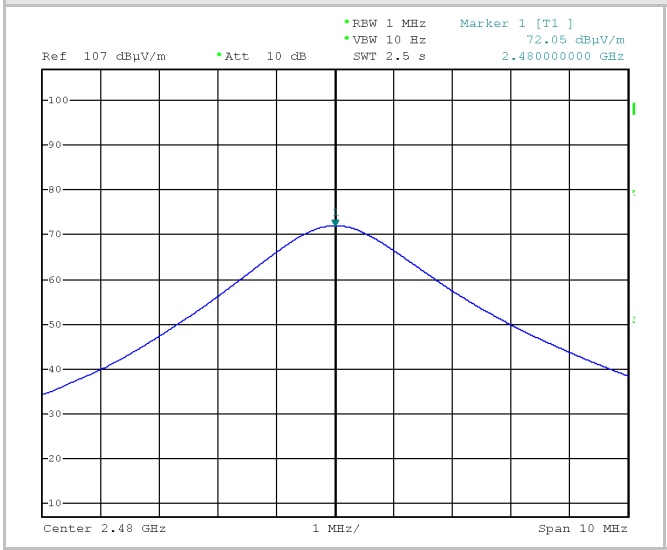
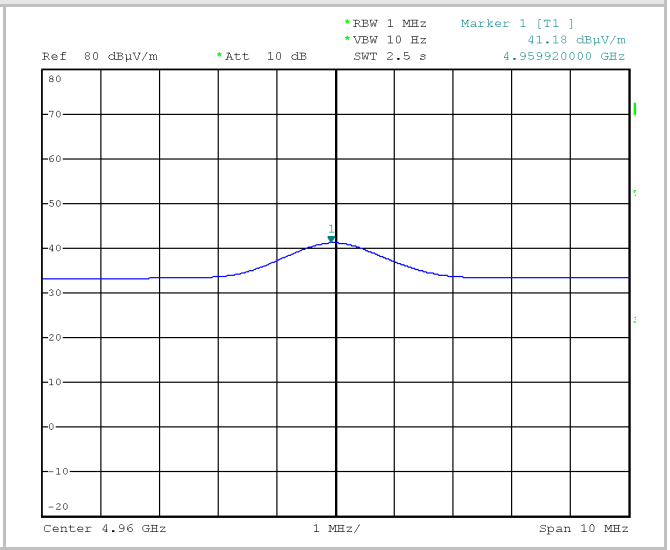
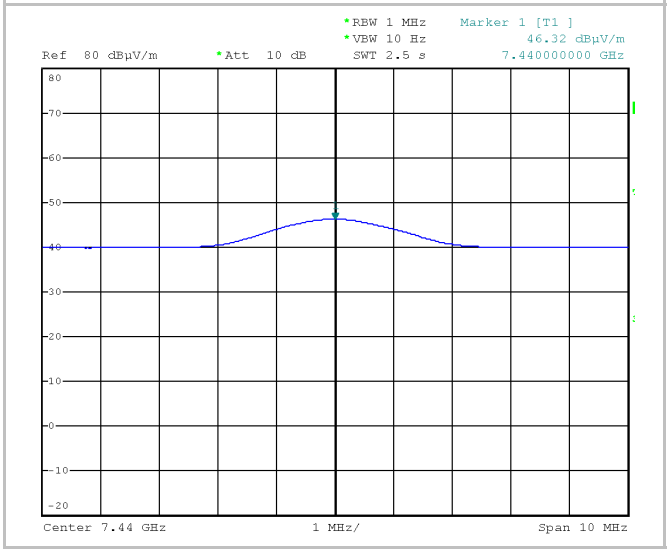
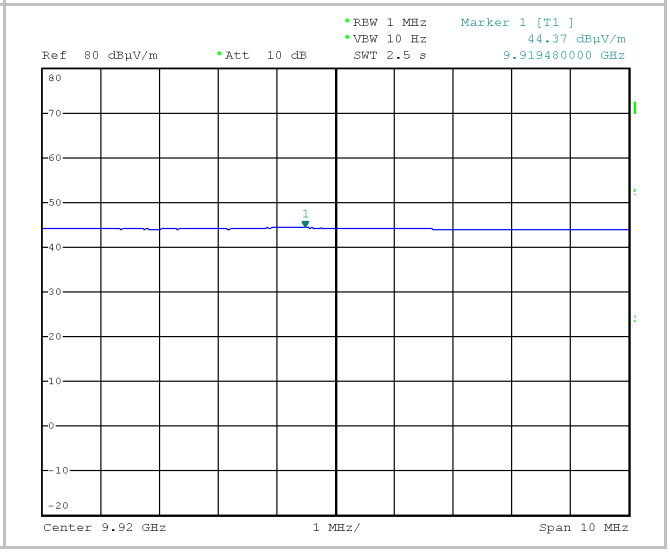
Higher channel (worst case detected)









7.4 6 dB BANDWIDTH

TEST REQUIREMENT	
Spectrum analyzer settings	
Span	2 MHz
Resolution bandwidth (RBW)	100 kHz
Video bandwidth (VBW)	300 kHz
Sweep time (SWT)	2,5 ms
Detector function	Peak
Trace	max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None
Testing dates	2018-10-05

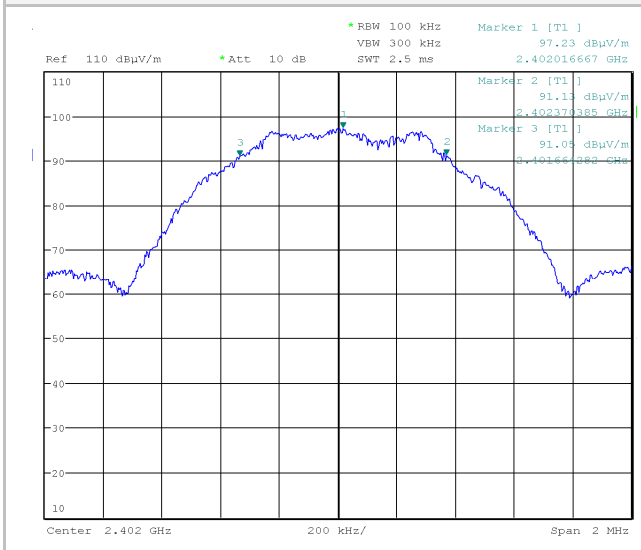
TEST RESULT
The EUT meets the requirements of sections 15.247 (a) (2)

TEST PROCEDURE
The EUT is set to transmit has its maximum data rate. The Channel bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.

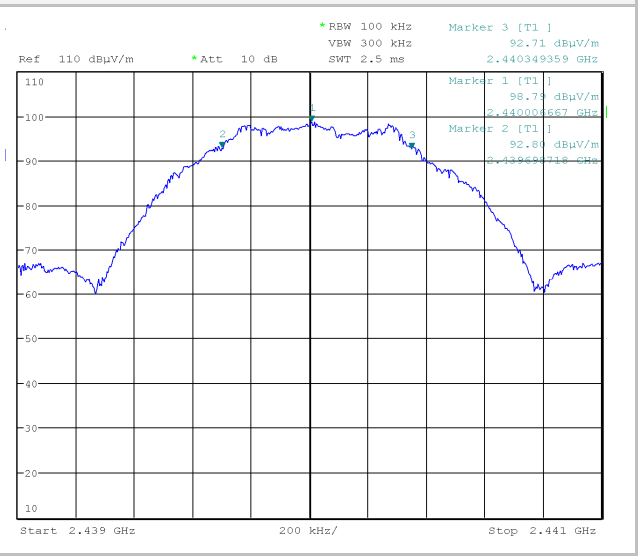
MEASUREMENTS RESULTS

Channel (No.)	Frequency (MHz)	Channel Bandwidth (MHz)	Plot (No.)
01	2402	0.706	1
20	2440	0.651	2
40	2480	0.686	3

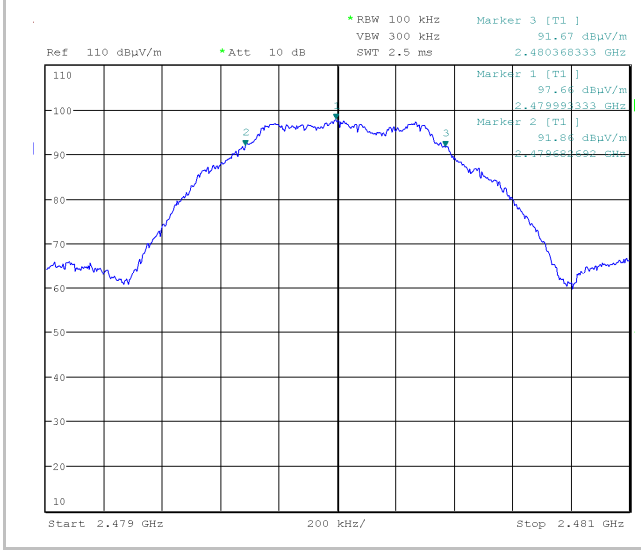
Plot 1



Plot 2



Plot 3



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7.5 MAXIMUM PEAK OUTPUT POWER (DE FACTO EIRP)

TEST REQUIREMENT	
Spectrum analyzer settings	
Resolution bandwidth (RBW)	10 MHz
Video bandwidth (VBW)	10 MHz
Sweep time (SWT)	2,5 ms
Detector function	Peak
Trace	max hold
Test distance	3 meters (for radiated measurement)
EUT operating condition	#1
Remark	**eirp = p_t x g_t = (E x d)^2/30** where: **pt** = transmitter output power in watts, **gt** = numeric gain of the transmitting antenna (unitless) -0.2 dBi, **E** = electric field strength in V/m, **d** = measurement distance in meters (m).
Testing dates	2018-10-05

TEST RESULT
The EUT meets the requirements of sections 15.247 (b) (3)

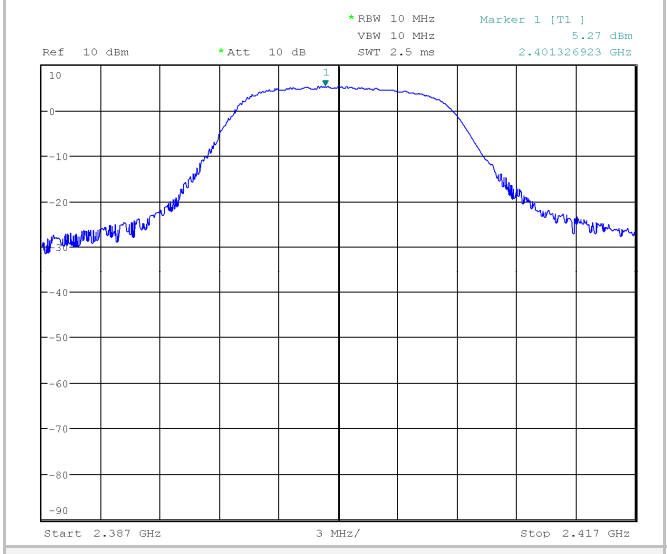
LIMITS
1 Watt (30dBm)

TEST PROCEDURE
Radiated measurements:
The effective radiated power is measured in a 3 m anechoic chamber.

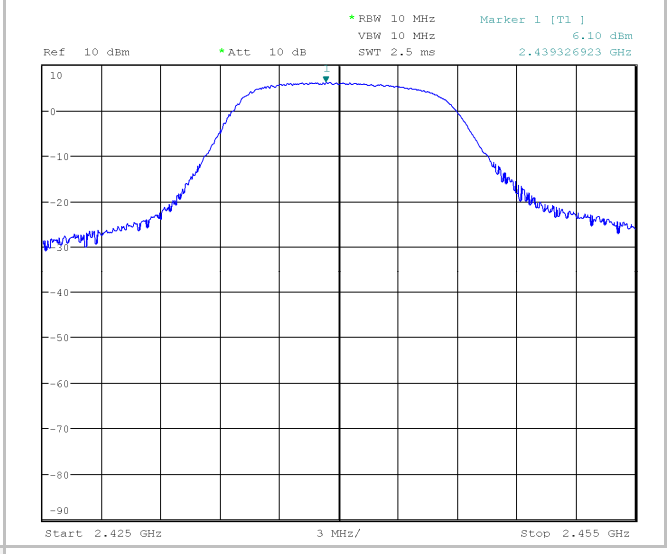
MEASUREMENTS RESULTS

Channel (No.)	Frequency (MHz)	Measured Power (dBm)	Output Power (mW)	Plot (No.)
01	2402	5.27	3.365	1
20	2440	6.10	4.074	2
40	2480	5.12	3.251	3

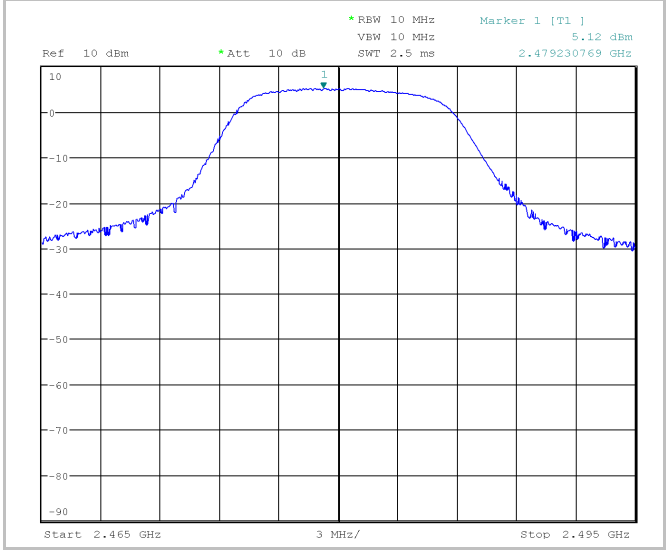
Plot 1



Plot 2



Plot 3



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7.6 BAND-EDGE COMPLIANCE OF RF RADIATED EMISSIONS

TEST REQUIREMENT	
Spectrum analyzer settings	
Span	Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation
Resolution bandwidth (RBW)	1 MHz (100 kHz band-edge)
Video bandwidth (VBW)	1 MHz (100 kHz band-edge)
Sweep time (SWT)	Auto
Detector function	Peak
Trace	Max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None
Testing dates	2018-10-05

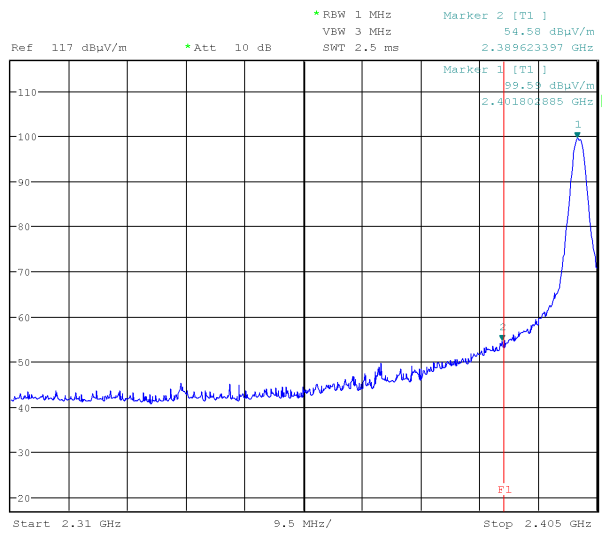
TEST RESULT
The EUT meets the requirements of sections 15.247 (d) All out of band spurious emissions are more 20 dB below the in band power of the fundamental.

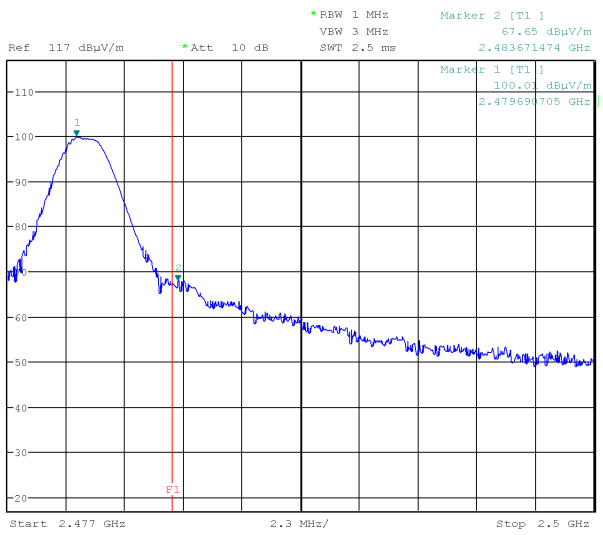
LIMITS
-20 dB below peak output power

TEST PROCEDURE
Only for measuring emissions up to 2 MHz removed from the band-edge the "delta" technique for Radiated emissions was used. Delta technique: The transmitter output was connected to the spectrum analyser through a test fixture (radio frequency coupling device associated with the dedicated antenna of the equipment under test) Once the trace is stabilized, by the marker the emission at the band edge (or on the highest modulation product outside of the band, if this level is greater than that at the band edge) was set. The “n” by the marker-delta function and the marker-to-peak function the peak of the in-band emission was selected. The marker-delta value displayed was compared with the limit specified in this Section

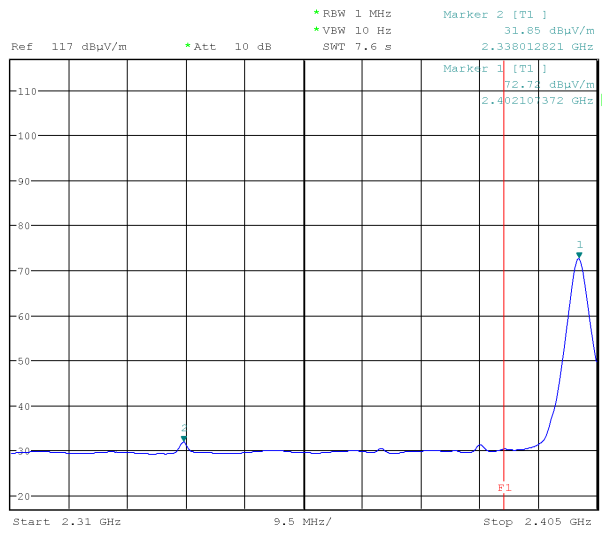
MEASUREMENTS RESULTS

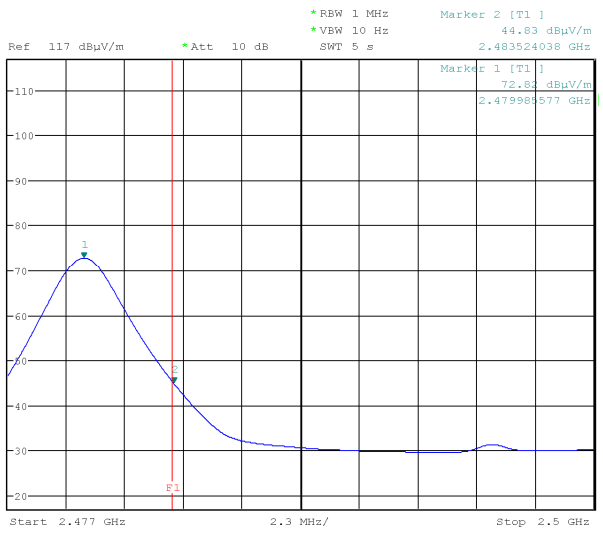
Band-edge compliance (Peak)





Band-edge compliance (Average)





Spurious Emission in restricted band near 2400-2483.5 MHz

Detector	Frequency	Reading value	Antenna Factor	Cable Loss	Pre-Amp. Gain	Correcting reading	PK Limit	PK Limit	Margin
	(GHz)	(dBµV)	(dB@3m)	(dB)	(dB)	(dBµV/m)	(µV/m)	(dBµV/m)	(dB)
PEAK	2.38	49.49	27.3	5.18	-37.57	54.58	5000	74	19.42
	2.48	62.66	27.4	5.18	-37.57	67.65	5000	74	6.35
AVERAGE	2.34	26.76	27.3	5.18	-37.57	31.85	500	54	22.15
	2.48	39.84	27.4	5.18	-37.57	44.83	500	54	9.17

7.7 RADIATED EMISSIONS OUTSIDE THE BAND

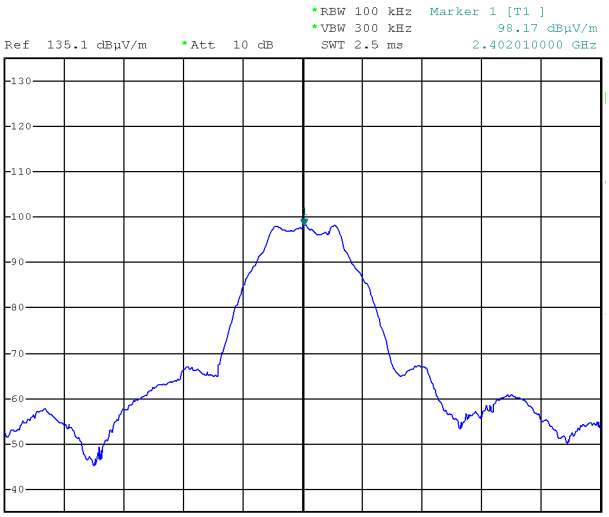
TEST REQUIREMENT	
Spectrum analyzer settings	
Span	/
Resolution bandwidth (RBW)	100 kHz
Video bandwidth (VBW)	300 kHz
Sweep time (SWT)	as necessary to capture the entire dwell time
Detector function	Peak
Trace	Max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None
Testing dates	2018-10-05

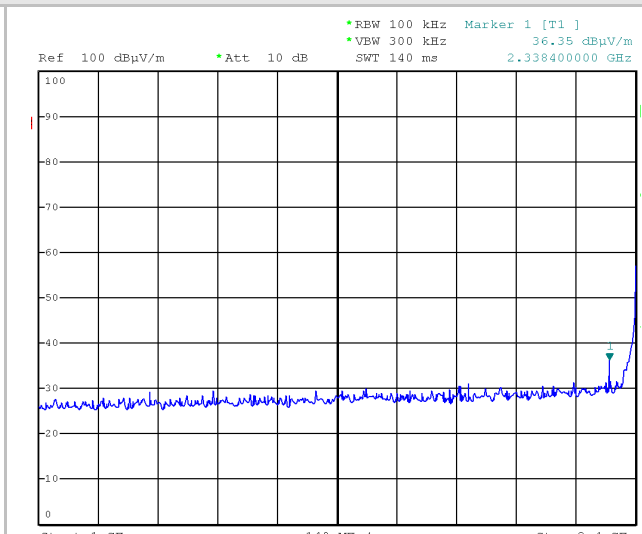
TEST RESULT
The EUT meets the requirements of sections 15.247 (d) All out of band spurious emissions are more 20 dB below the in band power of the fundamental. No significant spurious emissions above 18GHz.

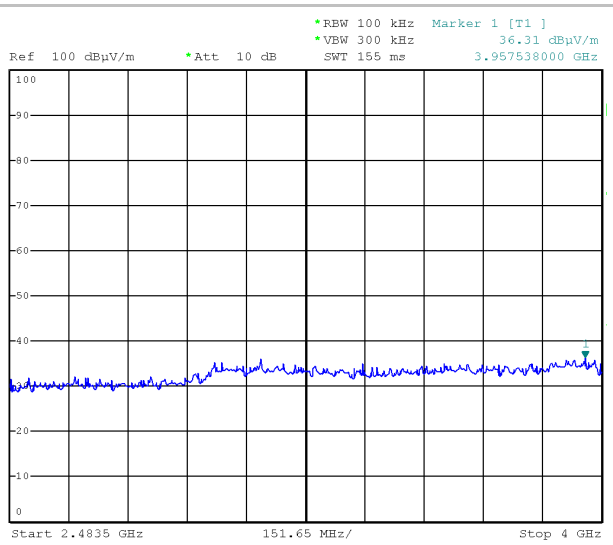
LIMITS
-20 dB below peak output power

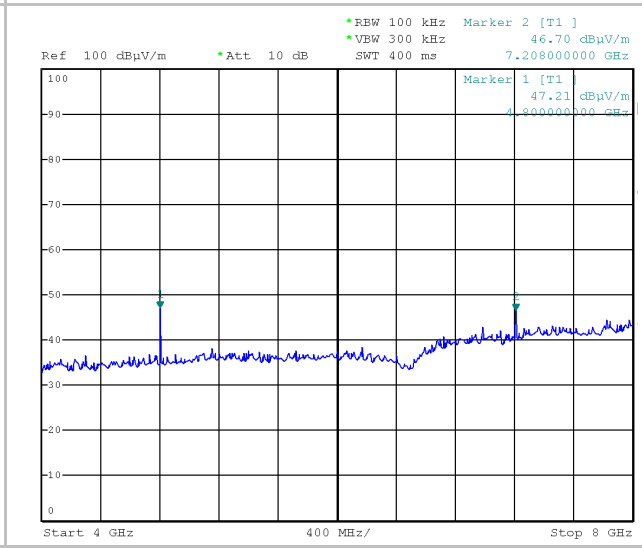
TEST PROCEDURE
As the conducted measurement cannot performed because the transmitter antenna is integrated has been carried out radiated measurement, according to KDB 558074 measurements guidance for DTS equipment. The field strength levels shall be converted to equivalent conducted power levels for comparison to the applicable output power limit refer to KDB 412172. The measure has been executed with the lowest transmit channel, the highest transmit channel and one located somewhere in the middle of the band.

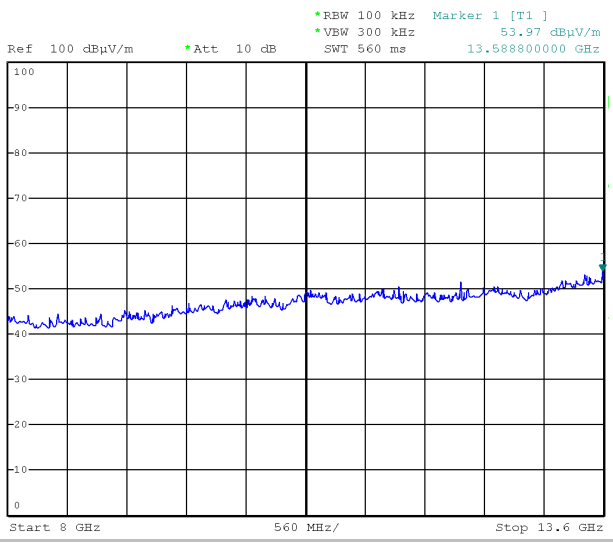
MEASUREMENTS RESULTS - Channel lower

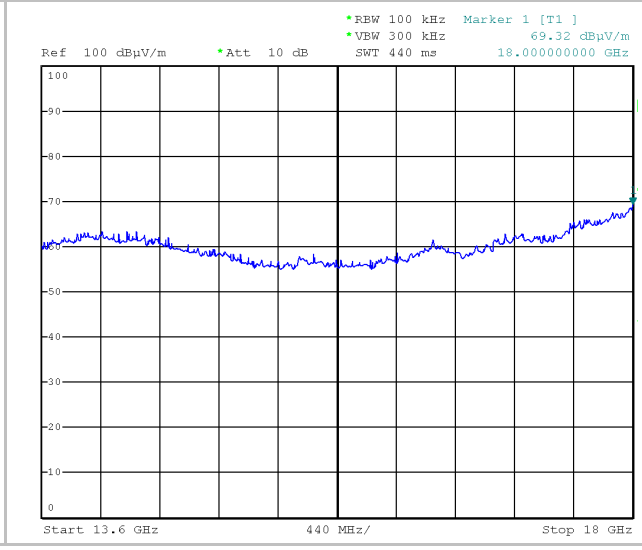




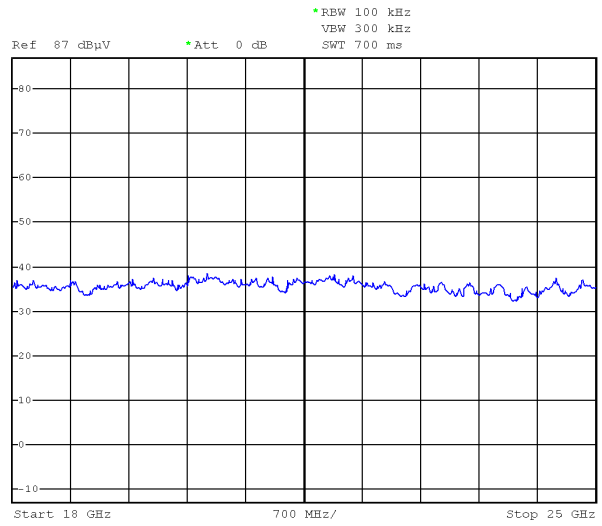








MEASUREMENTS RESULTS - Channel lower



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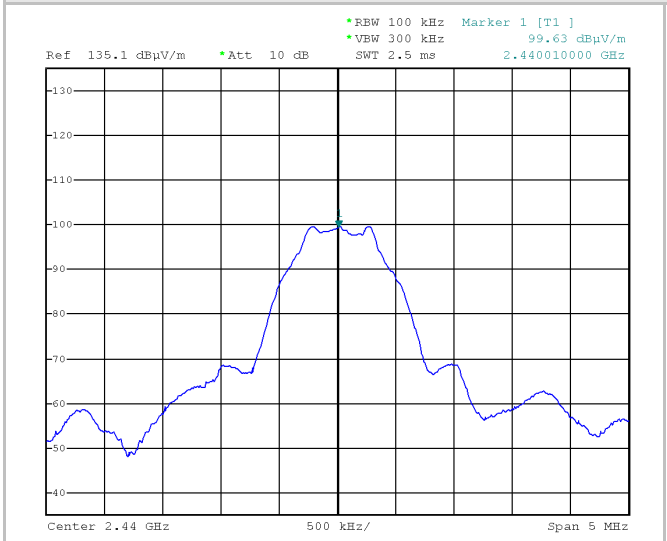
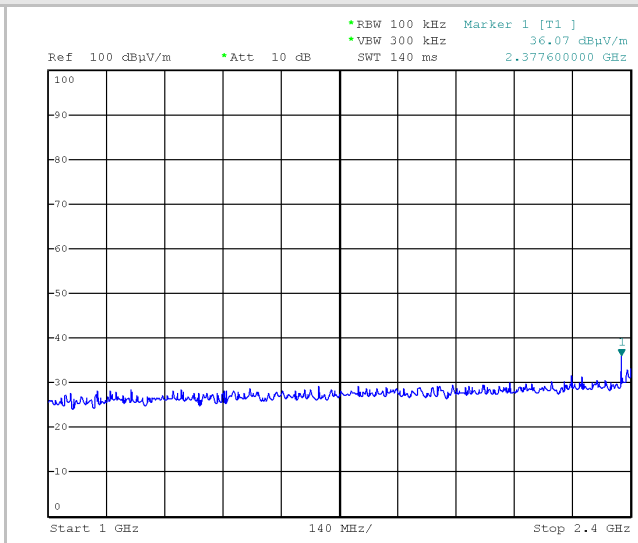
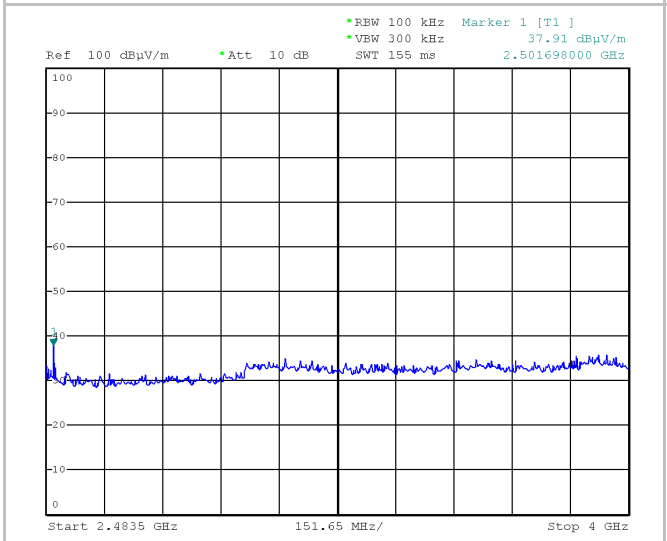
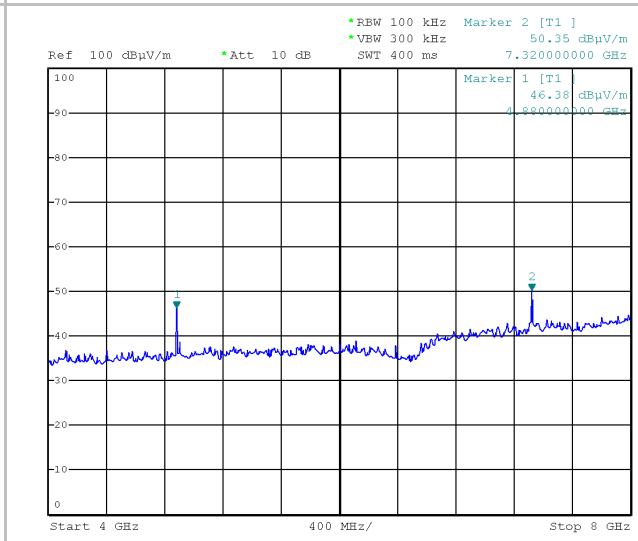
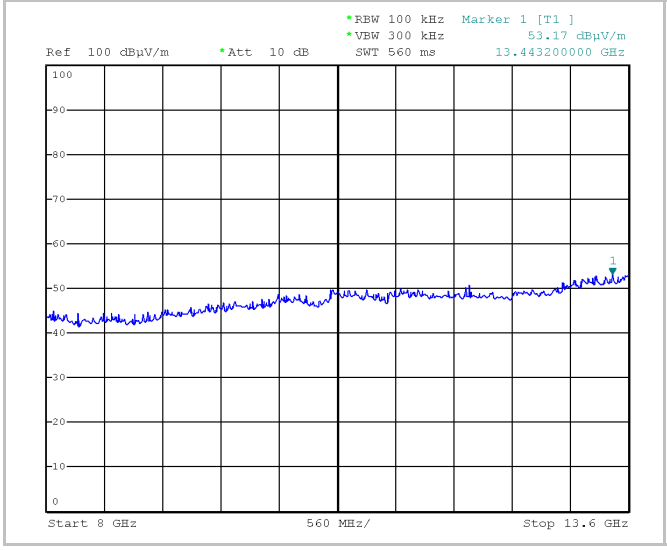
MEASUREMENTS RESULTS - CHANNEL MIDDLE

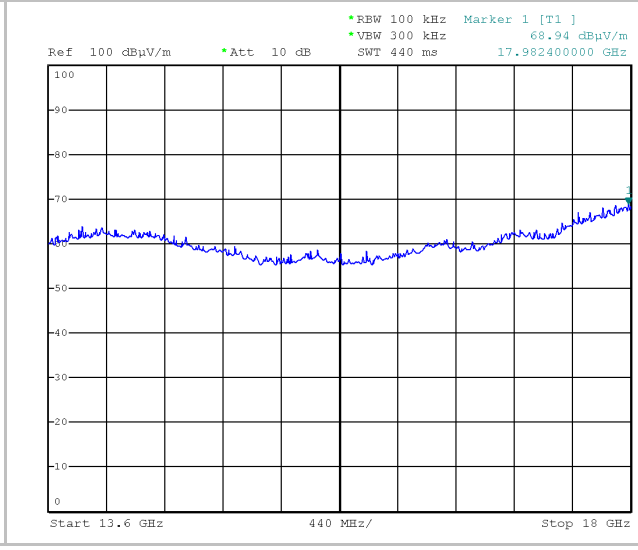




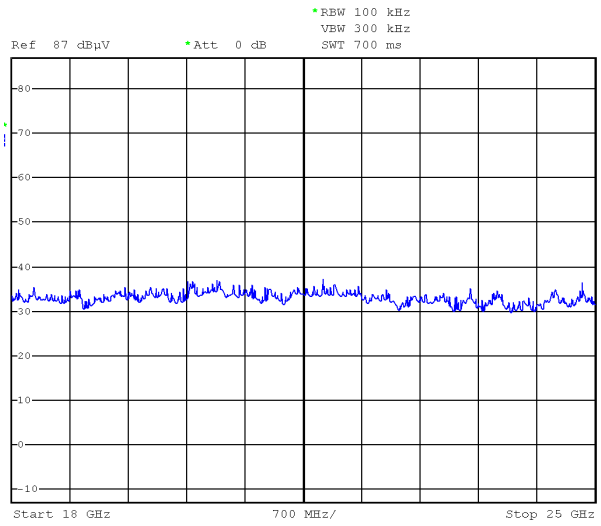








MEASUREMENTS RESULTS - Channel middle



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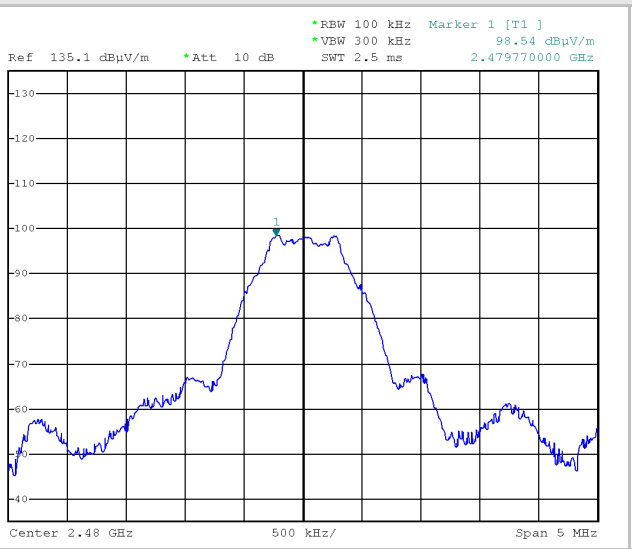
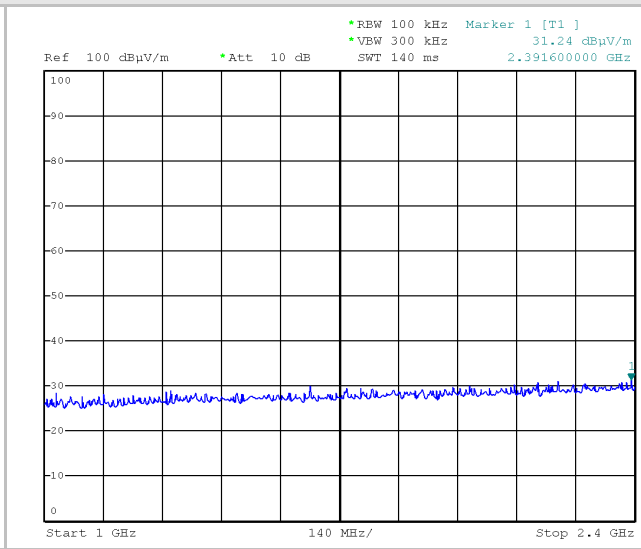
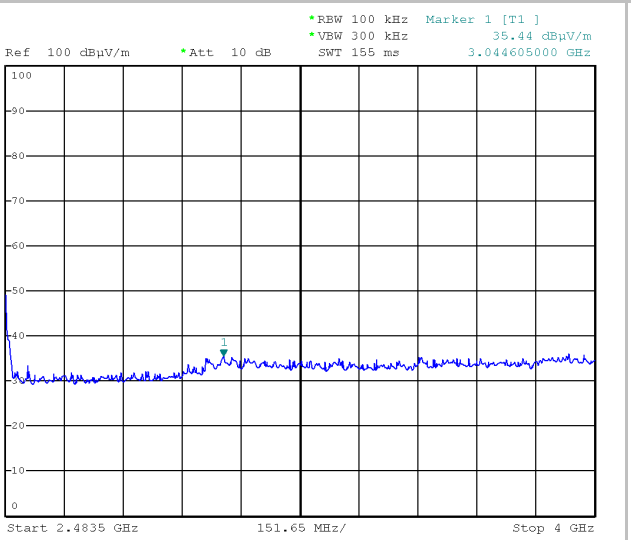
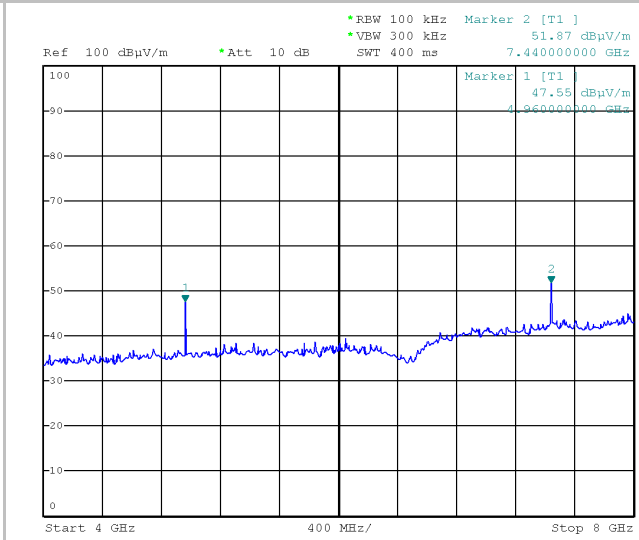
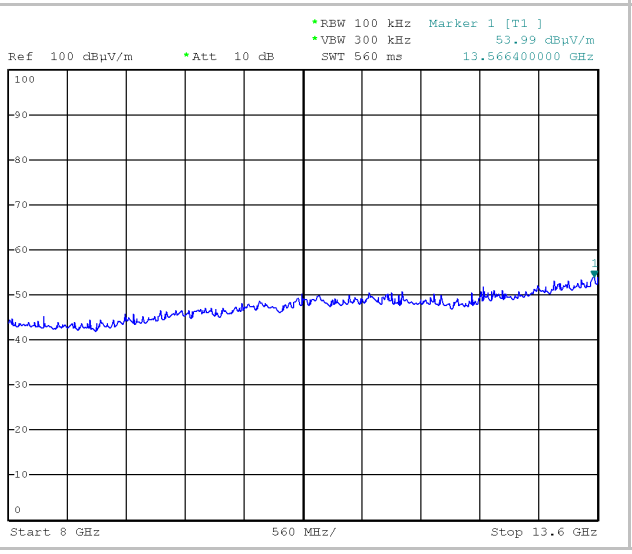
MEASUREMENTS RESULTS - CHANNEL HIGHER

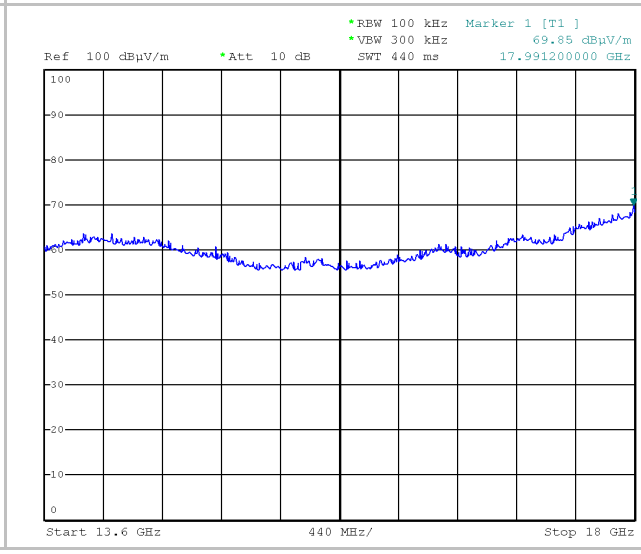




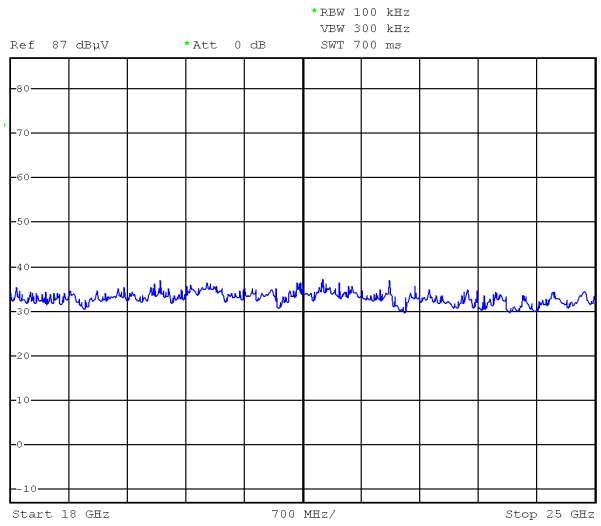








MEASUREMENTS RESULTS - Channel higher



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7.8 TRANSMITTER POWER SPECTRAL DENSITY

TEST REQUIREMENT	
Spectrum analyzer settings	
Span	1.5 MHz
Resolution bandwidth (RBW)	3 kHz
Video bandwidth (VBW)	10 kHz
Sweep time (SWT)	500 s
Detector function	Peak
Trace	Max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None
Testing dates	2018-10-05

TEST RESULT
The EUT meets the requirements of sections 15.247 (e)

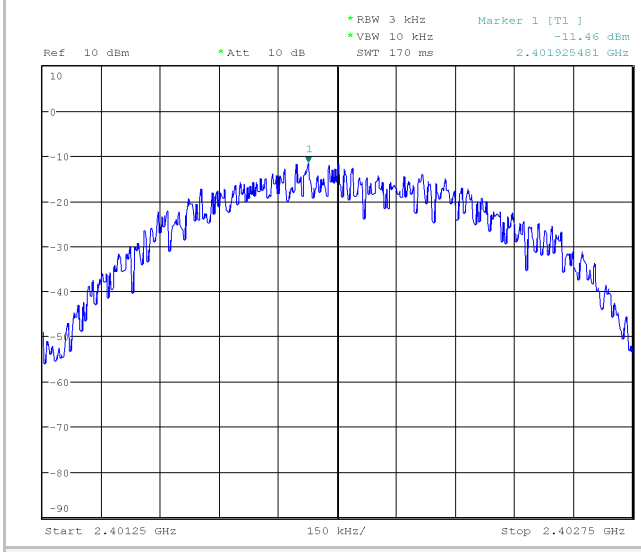
LIMITS
8 dBm in 3 kHz bandwidth.

TEST PROCEDURE
After trace stabilisation the marker shall be set on the signal peak. The indicated level is the power spectral density.

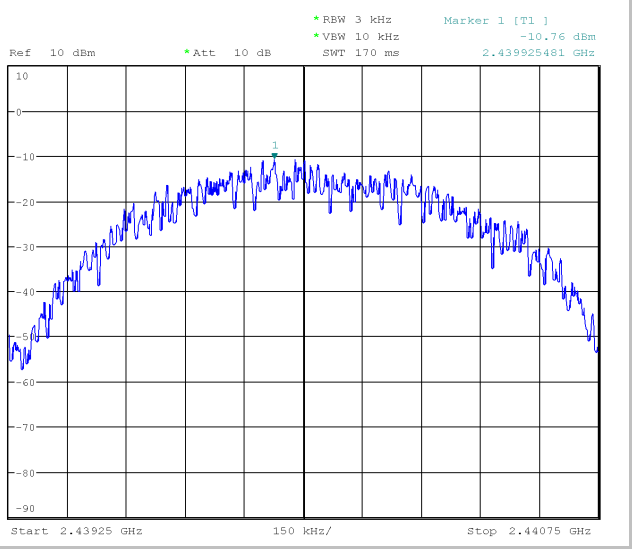
MEASUREMENTS RESULTS

Channel (No.)	Frequency (MHz)	Measured Power (dBm)	Limit (dBm)	Plot (No.)
01	2402	-11.46	8	1
20	2440	-10.76	8	2
40	2480	-11.29	8	3

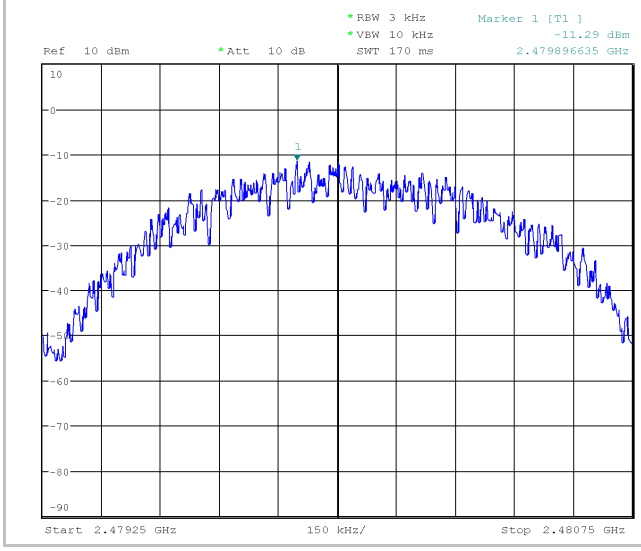
Plot 1



Plot 2



Plot 3



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7.9 RF EXPOSURE EVALUATION

TEST REQUIREMENT	
Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines § 1.1307(b)(1).	
EUT classification (fixed, mobile or portable devices)	Portable according to § 2.1093(b) of this Chapter
LIMITS	According to § 2.1093 of this Chapter, by means of the following guidelines: OET Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies (447498 D01 General RF Exposure Guidance v06)
Testing dates	2018-10-05

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

447498 D01 General RF Exposure Guidance v06 – Appendix A

MHz	**5**	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	**10**	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

The test separation distances ≥ 5 mm is applied to determine SAR test exclusion.

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

447498 D01 General RF Exposure Guidance v06 § 4.3

Channel No.	Frequency (MHz)	Radiated power (dBm)	Radiated power (mW)	Distance (mm)	$\frac{max.\ power\ (mW)}{min.distance\ (mm)} \cdot \sqrt{f_{(GHz)}}$	Limits
01	2402	5.27	3.365	5	1.043	≤ 3.0 for 1-g head SAR or ≤ 7.5 for 10-g extremity SAR
20	2440	6.10	4.074	5	1.273	
40	2480	5.12	3.251	5	1.024	

Declared by manufacturer

Channel No.	Frequency (MHz)	Max Power declared (dBm)	Max. antenna gain (peak) (dBi)	Max. level.		Distance (mm)	$\frac{max.\ power\ (mW)}{min.distance\ (mm)} \cdot \sqrt{f_{(GHz)}}$	Limits
				(dBm)	(mW)			
01	2402	8	+0.5	8.5	7.079	5	2.194	≤ 3.0 for 1-g head SAR or ≤ 7.5 for 10-g extremity SAR
20	2440	8	+0.5	8.5	7.079	5	2.212	
40	2480	8	+0.5	8.5	7.079	5	2.230	

TEST RESULT

This value is less than the low threshold limit. No SAR test is required.

Maximum radiated power was taken into consideration to establish the worst case aggregate maximum output power.

8. MEASUREMENTS AND TESTS UNCERTAINTY

Unless otherwise stated the uncertainties for the tests and measurements are evaluated in according to IMQ Operational Instruction IO-LAB-001 and IO-LAB-004. and requirement of NIST Technical Note 1297 and NIS 81: 1994 "The Treatment of Uncertainty in EMC Measurements"

The expanded uncertainty was calculated for all measurements and tests listed in this test report according to CISPR 16-4-2 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainty in EMC Measurements", with UKAS document LAB 34 and is documented in the quality system accordance to ISO/IEC 17025.

Internal Procedure PG-037 ensures that the requirements for traceability of calibrations, of all test equipment requiring calibration, and calibration intervals are met.

Methods/Standard	Parameter	Expanded Uncertainty	Unit	Confidence level
Continuous disturbance	QP detector 9 – 150 kHz	2.47	dB	95%
	QP detector 150 k – 30 MHz	2.61	dB	95%
	QP detector using Voltage Probe	2.45	dB	95%
	QP detector using ISN	3.15	dB	95%
	QP detector using Current Probe	2.15	dB	95%
Radiated disturbance	QP detector (30 MHz - 100 MHz) H polarization	4.33	dB	95%
	QP detector (30 MHz - 100 MHz) V polarization	4.22	dB	95%
	QP detector (100 MHz - 200 MHz) H polarization	3.40	dB	95%
	QP detector (100 MHz - 200 MHz) V polarization	4.76	dB	95%
	QP detector (200 MHz - 1000 MHz) H polarization	3.91	dB	95%
	QP detector (200 MHz - 1000 MHz) V polarization	3.82	dB	95%
	P detector 1 - 6 GHz	4.77	dB	95%
	P detector 6 - 18 GHz	5.14	dB	95%
	P detector 18 - 26 GHz	4.95	dB	95%
	P detector 26 - 40 GHz	5.20	dB	95%

9. LIST OF MEASURING EQUIPMENT AND CALIBRATION INFORMATION

IMQ Serial Number	Instrument	Manufacturer	Type	Last Cal.	Cal. Period.	Calibration Company
P01709	Shielded semi-anechoic chamber	SIDT	/	03-17	24	IMQ
P02486	Turntable controller unit	FRANKONIA	FCTAM01	/	/	/
P02488	Mast antenna	FRANKONIA	FAM4	/	/	/
S02385	Log antenna	ARA	LPB-2513	06-17	36	NPL
S03463	Horn Antenna	SCHWARZBECK	BBHA 9120D	07-17	36	NPL
S02508	Loop Antenna	ROHDE & SCHWARZ	HFH2-Z2	08-18	24	SEIBERSDORF
S03629	Spectrum Analyzer	Rohde & Schwarz	FSP40	08-17	12	ROHDE & SCHWARZ
S03542	Preamplifier	Hewlett Packard	HP 8449B	03-18	12	IMQ
W-00199/E	Software	ROHDE & SCHWARZ	EMC32 Ver. 6.30	/	/	/
H-00165	PC	/	/	/	/	/

END OF TEST REPORT