

TEST REPORT

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
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Report No.:
KR16-SRF0043-A

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KCTL**1. Client**

- Name : NEW OPTICS LTD.
- Address : 315, Hyuam-ro 392beon-gil, Nam-myeon, Yangju-si,
Gyeonggi-do, Republic of Korea
- Date of Receipt : 2016-06-01

2. Use of Report : -**3. Name of Product and Model** : Digital Canvas 265SQ / 265BXQ7W-UC**4. Manufacturer and Country of Origin** : NEW OPTICS LTD. / Korea**5. FCC ID** : 2AIWQ-265BXQ7W-UC**6. IC** : 22127-265BXQ7W**7. Date of Test** : 2016-10-21 to 2016-10-31**8. Test Standards** : FCC Part 15 Subpart C 15.247
RSS-247 Issue 1 May 2015
RSS GEN Issue 4 November 2014**9. Test Results** : Refer to the test result in the test report

Affirmation	Tested by	Technical Manager
	 Name : Euijung Kim (Signature)	 Name : Changmin Kim (Signature)

2017-02-09

KCTL Inc.

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.


REPORT REVISION HISTORY

Date	Revision	Page No
2016-11-03	Originally issued	-
2017-02-09	Delete ID from IC ID and Test Standards revised.	1

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1. Client information

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Manufacturer: NEW OPTICS LTD.
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2. Laboratory information

Address

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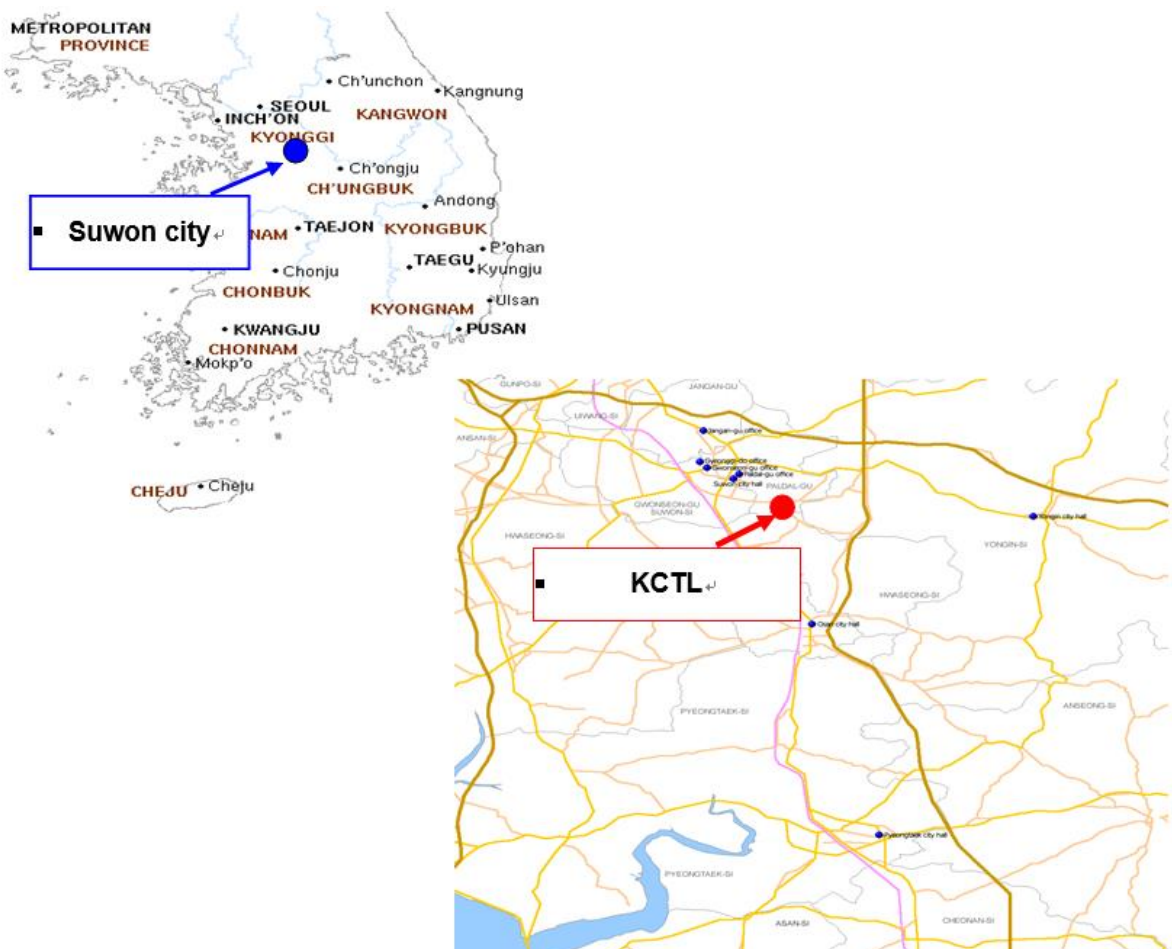
FCC Site Designation No: KR0040, FCC Site Registration No: 687132

VCCI Registration No. : R-3327, G-198, C-3706, T-1849

Industry Canada Registration No. : 8035A

KOLAS NO.: KT231

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant:	NEW OPTICS LTD.
Address of Applicant	315, Hyuam-ro 392beon-gil, Nam-myeon, Yangju-si, Gyeonggi-do, Republic of Korea
Manufacturer	NEW OPTICS LTD.
Address of Manufacturer	315, Hyuam-ro 392beon-gil, Nam-myeon, Yangju-si, Gyeonggi-do, Republic of Korea
Type of equipment	Digital Canvas 265SQ
Basic Model	265BXQ7W-UC
Variant Model ¹⁾	265BXQ7W-US, 265BXQ7W-UW, 265BXQ7W-NC, 265BXQ7W-NS, 265BXQ7W-NW, 265BXQ4W-UC, 265BXQ4W-US, 265BXQ4W-UW, 265BXQ4W-NC, 265BXQ4W-NS, 265BXQ4W-NW, 265BXQ7W-KC, 265BXQ4W-KC, 265BSQ7W-KC, 265BSQ4W-KC
Serial number	N/A

¹⁾ Difference of Buyer or Buyer's Solution.

3. Description of E.U.T.

3.2 General description

Frequency Range	2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20), 2 402 MHz ~ 2 480 MHz (Bluetooth, Bluetooth Low Energy), 5 180 MHz ~ 5 240 MHz (802.11a), 5 260 MHz ~ 5 320 MHz (802.11a), 5 500 MHz ~ 5 700 MHz (802.11a), 5 745 MHz ~ 5 825 MHz (802.11a)
Type of Modulation	DSSS (802.11b), OFDM (802.11a/g/n_HT20), GFSK (Bluetooth, Bluetooth Low Energy), $\pi/4$ DQPSK, 8DPSK (Bluetooth)
Number of Channels	2.4 GHz: 11 ch (802.11b/g/n_HT20), 79 ch (Bluetooth), 40 ch (Bluetooth Low Energy) 5 GHz: 5 150 MHz Band: 4 (802.11a), 5 250 MHz Band: 4 (802.11a) 5 470 MHz Band: 11 (802.11a), 5 725 MHz Band: 4 (802.11a)
Type of Antenna	FPCB Cable Antenna
Antenna Gain	-4.50 dBi (2 400 MHz ~ 2 483.5 MHz), -3.50 dBi (5 150 MHz ~ 5 850 MHz)
Transmit Power	7.65 dBm
Power supply	DC 24.00 V
Product SW/HW version	Android 4.4.4 or Above
Radio SW/HW version	5.90.195.89.13
Test SW Version	RF Test Tool V4.7
RF power setting in TEST SW	Referred the measuring instrument from manufacturer

Note : The above EUT information was declared by the manufacturer.

3.3 Test frequency

	Frequency
Lowest frequency	2 402 MHz
Middle frequency	2 440 MHz
Highest frequency	2 480 MHz

3.4 Test Voltage

Mode	Voltage
Nominal voltage	DC 24.00 V

4. Summary of test results

4.1 Standards & results

FCC Rule Reference	IC Rule Reference	Parameter	Report Section	Test Result
15.203, 15.247(b)(4)	-	Antenna Requirement	5.1	C
15.247(b)(3)	RSS-247, 5.4(4)	Maximum Peak Output Power	5.2	C
15.247(e)	RSS-247, 5.2	Peak Power Spectral Density	5.3	C
15.247(a)(2)	RSS-247, 5.2	6 dB Channel Bandwidth	5.4	C
-	RSS-GEN, 6.6	Occupied Bandwidth	5.4	C
15.247(d), 15.205(a), 15.209(a)	RSS-247, 5.5 RSS-GEN, 8.9, 10	Spurious Emission, Band Edge, and Restricted bands	5.5	C
15.207(a)	RSS-GEN, 8.8	Conducted Emissions	5.6	C

Note: C = complies, NC = Not complies, NT = Not tested, NA = Not Applicable

Note: The general test methods used to test this device is ANSI C63.10:2013

4.2 Uncertainty

Measurement Item	Expanded Uncertainty $U = kU_c (k = 2)$	
Conducted RF power	1.44 dB	
Conducted Spurious Emissions	1.52 dB	
Radiated Spurious Emissions	30 MHz ~ 300 MHz:	+4.94 dB, -5.06 dB
		+4.93 dB, -5.05 dB
	300 MHz ~ 1 000 MHz:	+4.97 dB, -5.08 dB
		+4.84 dB, -4.96 dB
Conducted Emissions	1 GHz ~ 25 GHz:	+6.03 dB, -6.05 dB
	9 kHz ~ 150 kHz:	3.75 dB
	150 kHz ~ 30 MHz:	3.36 dB

5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

5.1.1.1 Regulation for FCC

According to §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 so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.1.1.2 Regulation for IC

According to § RSS GEN Issue 4, 6.2, As per RSP-100, each applicant for equipment certification must provide a list of all antenna types that may be used with the transmitter, indicating the maximum permissible antenna gain (in dBi).

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer. The test report shall state the RF power, output power setting and spurious emission measurements, including the antenna type used.

In addition, applicants shall perform RF power and spurious emission measurements with each antenna type supplied or specified by the manufacturer for use with the transmitter.

5.1.2 Result

- Complied

The transmitter has permanently attached FPCB Cable Antenna (internal antenna) on board.

5.2 Maximum Peak Output Power

5.2.1 Regulation

5.2.1.1 Regulation for FCC

According to §15.247(b)(3), For systems using digital modulation in the 902-928 MHz, 2 400-2 483.5 MHz, and 5 725-5 850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2.1.2 Regulation for IC

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2 400-2 483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power.

The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

5.2.2 Measurement Procedure

These test measurement settings are specified in section 9.0 of 558074 D01 DTS Meas Guidance.

5.2.2.1 PKPM1 Peak power meter method

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

5.2.3 Test Result

- Complied

Channel	Frequency [MHz]	Result [dBm]	Limit [dBm]	Margin [dB]	Avarage Power [dBm]
Lowest	2 402	7.35	30.00	22.65	6.90
Middle	2 440	7.65	30.00	22.35	7.20
Highest	2 480	7.35	30.00	22.65	6.90

-NOTE:

1. We took the insertion loss of the cable loss into consideration within the measuring instrument.
2. It was measured by peak power sensor.

5.3 Peak Power Spectral Density

5.3.1 Regulation

5.3.1.1 Regulation for FCC

According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.3.1.2 Regulation for IC

DTSs include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequence systems.

The following applies to the bands 902-928 MHz and 2 400- 2 483.5 MHz:

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of Section 5.4(4), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

5.3.2 Measurement Procedure

These test measurement settings are specified in section 10.0 of 558074 D01 DTS Meas Guidance.

5.3.2.1 Method PKPSD (peak PSD)

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

- 1) Set analyzer center frequency to DTS channel center frequency.
- 2) Set the span to 1.5 times the DTS bandwidth.
- 3) Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- 4) Set the VBW $\geq 3 \times \text{RBW}$.
- 5) Detector = peak.
- 6) Sweep time = auto couple.
- 7) Trace mode = max hold.
- 8) Allow trace to fully stabilize.
- 9) Use the peak marker function to determine the maximum amplitude level within the RBW.
- 10) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.3.3 Test Result

- Complied

Channel	Frequency [MHz]	Result (RBW=100 kHz) [dBm]	Result (RBW=3 kHz) [dB m]	Limit	Margin [dB]
Lowest	2 402	5.91	-7.99	8 dBm/3 kHz	15.99
Middle	2 440	6.19	-7.66	8 dBm/3 kHz	15.66
Highest	2 480	5.96	-8.00	8 dBm/3 kHz	16.00

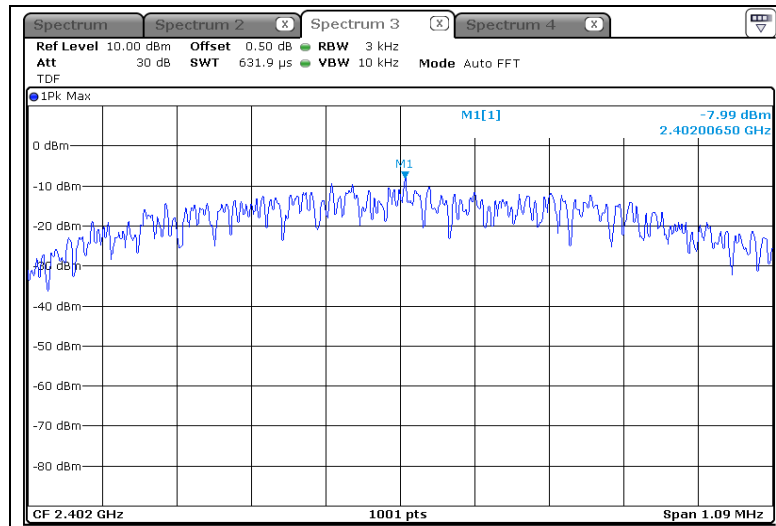
-NOTE:

1. We took the insertion loss of the cable loss into consideration within the measuring instrument.

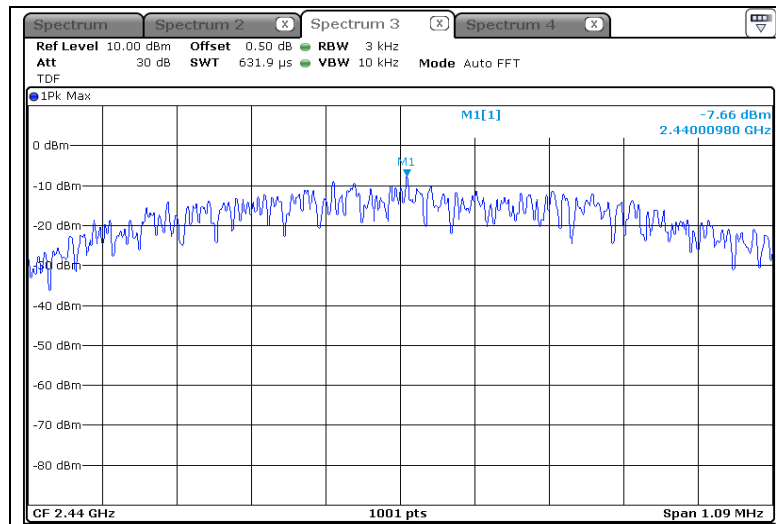
5.3.4 Test Plot

Figure 1. Plot of the Power Density

Lowest Channel (2 402 MHz)



Middle Channel (2 440 MHz)



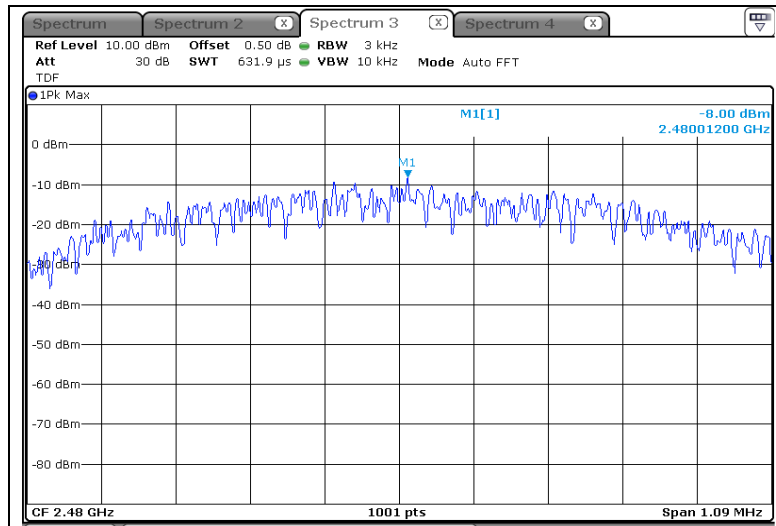
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Highest Channel (2 480 MHz)



5.4 6 dB Bandwidth(DTS Channel Bandwidth)

5.4.1 Regulation

5.4.1.1 Regulation for FCC

According to §15.247(a)(2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2 400–2 483.5 MHz, and 5 725–5 850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.4.1.2 Regulation for IC

According to §RSS-247, 5.2, DTSs include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequence systems.


The following applies to the bands 902-928 MHz and 2 400- 2 483.5 MHz:

The minimum 6 dB bandwidth shall be 500 kHz.

Occupied Bandwidth

According to § RSS GEN Issue 4, 6.6, The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth. When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

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A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

5.4.2 Measurement Procedure

These test measurement settings are specified in section 8.0 of 558074 D01 DTS Meas Guidance.

5.4.2.1 DTS Channel Bandwidth-Option 1

- 1) Set RBW = 100 kHz.
- 2) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- 3) Detector = Peak.
- 4) Trace mode = max hold.
- 5) Sweep = auto couple.
- 6) Allow the trace to stabilize.
- 7) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.4.2.2 DTS Channel Bandwidth Measurement Procedure-Option 2

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW $\geq 3 \times$ RBW, peak detector with maximum hold) is implemented by the instrumentation function.

When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

5.4.3 Test Result

- Complied

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	Min. Limit [MHz]	Occupied Bandwidth (99 % BW) [MHz]
Lowest	2 402	0.73	0.50	1.04
Middle	2 440	0.73	0.50	1.04
Highest	2 480	0.73	0.50	1.04

-NOTE:

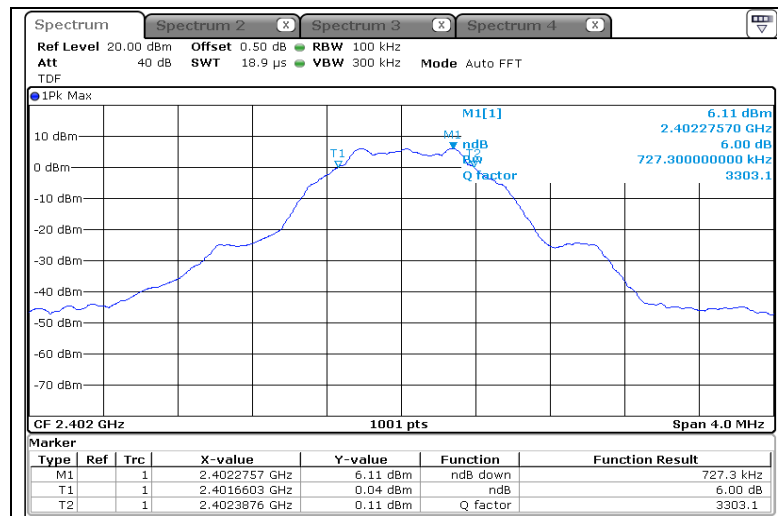
1. We took the insertion loss of the cable loss into consideration within the measuring instrument.

5.4.4 Test Plot

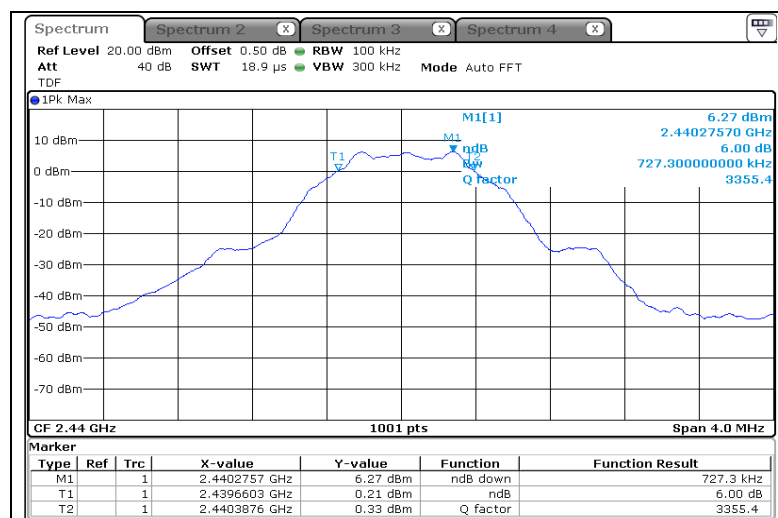
Figure 2. Plot of the 6dB Bandwidth & Occupied Bandwidth

- 6 dB Bandwidth

Lowest Channel (2 402 MHz)



Middle Channel (2 440 MHz)



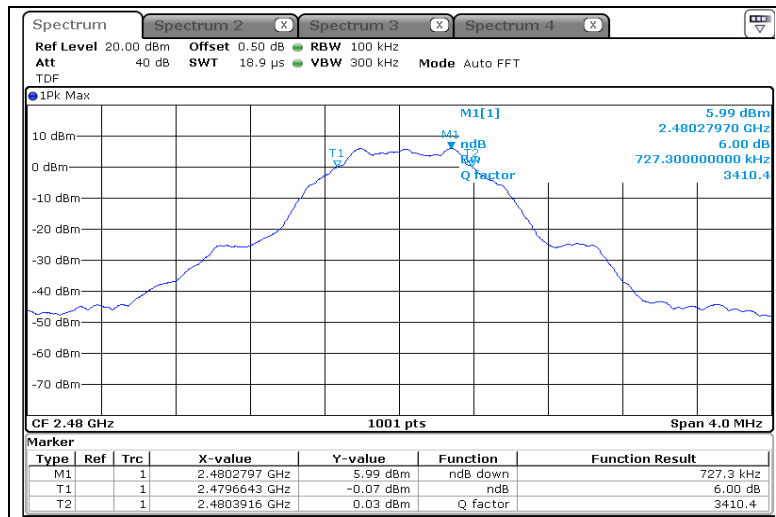
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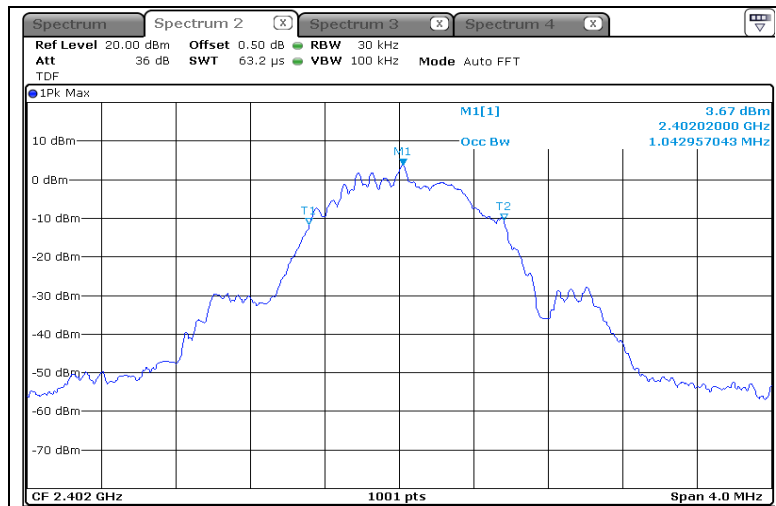
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Highest Channel (2 480 MHz)



- OBW

Lowest Channel (2 402 MHz)



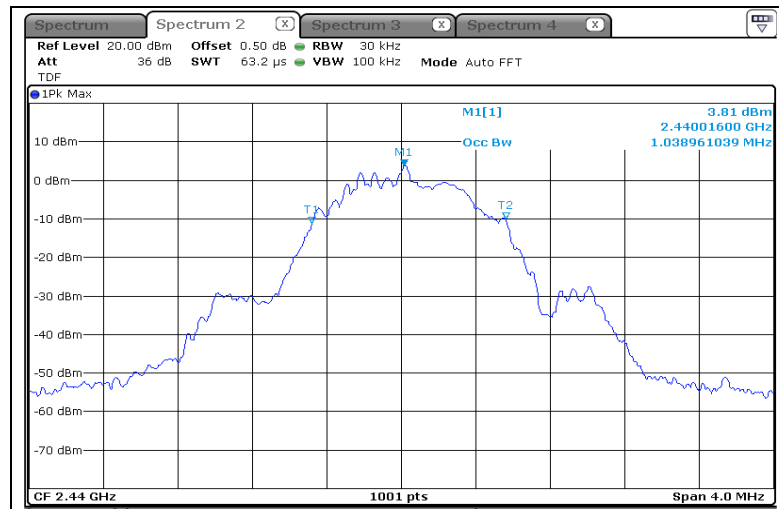
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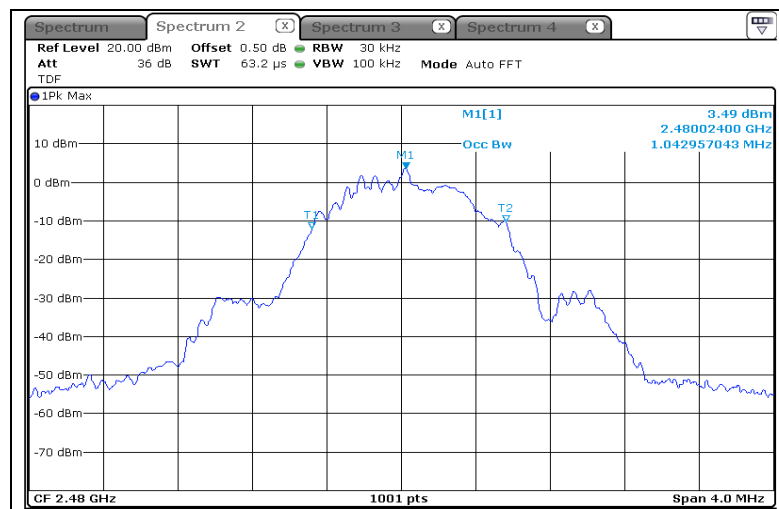
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Middle Channel (2 440 MHz)



Highest Channel (2 480 MHz)



5.5 Spurious Emission, Band Edge, and Restricted bands

5.5.1 Regulation

5.5.1.1 Regulation for FCC

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

According to §15.209(a), Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength ($\mu\text{V}/\text{m}$)	Measurement distance (m)
0.009 - 0.490	2 400/F(kHz)	300
0.490 - 1.705	24 000/F(kHz)	30
1.705 - 30	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §15.231 and 15.241.

According to § 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.009 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 – 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 – 1 427	8.025 - 8.5
4.177 25 - 4.177 75	37.5 - 38.25	1 435 – 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 – 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 – 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 – 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 – 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 – 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525 25	2 483.5 – 2 500	17.7 - 21.4
8.376 25 - 8.386 75	156.7 - 156.9	2 690 – 2 900	22.01 - 23.12
8.414 25 - 8.414 75	162.012 5 - 167.17	3 260 – 3 267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3 332 – 3 339	31.2 - 31.8
12.519 75 - 12.520 25	240 - 285	3 345.8 – 3 358	36.43 - 36.5
12.576 75 - 12.577 25	322 - 335.4	3 600 – 4 400	Above 38.6
13.36 - 13.41			

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1 000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

5.5.1.2 Regulation for IC

According to §RSS-247, 5.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS Gen is not required.

According to § RSS GEN Issue 4, 8.9, Except when the requirements applicable to a given device State otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 and Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 4 – General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (µV/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

* Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

Table 5 – General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Below 30 MHz

Frequency	Electric Field Strength ($\mu\text{V/m}$)	Magnetic Field Strength (H-Field) ($\mu\text{A/m}$)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1,705-30 MHz	30	N/A	30

According to § RSS GEN Issue 4, 8.10, Restricted bands, identified in Table 6, are designated primarily for safety-of-life services (distress calling and certain aeronautical bands), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following restrictions apply:

- (a) Fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of Table 6 except for apparatus complying under RSS-287;
- (b) Unwanted emissions that fall into restricted bands of Table 6 shall comply with the limits specified in RSS-Gen; and
- (c) Unwanted emissions that do not fall within the restricted frequency bands of Table 6 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

Table 6 – Restricted Frequency Bands*

MHz	MHz	GHz
0.090-0.110	240-285	9.0-9.2
2.1735-2.1905	322-335.4	9.3-9.5
3.020-3.026	399.9-410	10.6-12.7
4.125-4.128	608-614	13.25-13.4
4.17725-4.17775	960-1427	14.47-14.5
4.20725-4.20775	1435-1626.5	15.35-16.2
5.677-5.683	1645.5-1646.5	17.7-21.4
6.215-6.218	1660-1710	22.01-23.12
6.26775-6.26825	1718.8-1722.2	23.6-24.0
6.31175-6.31225	2200-2300	31.2-31.8
8.291-8.294	2310-2390	36.43-36.5
8.362-8.366	2655-2900	Above 38.6
8.37625-8.38675	3260-3267	* Certain frequency bands listed in Table 6 and in bands above 38.6 GHz are designated for licence exempt applications. These frequency bands and the requirements that apply to the devices are set out in the 200- and 300-series of RSSs, such as RSS-210 and RSS-310, which contain the requirements that apply to licence-exempt radio apparatus.
8.41425-8.41475	3332-3339	
12.29-12.293	3345.8-3358	
12.51975-12.52025	3500-4400	
12.57675-12.57725	4500-5150	
13.36-13.41	5350-5460	
16.42-16.423	7250-7750	
16.69475-16.69525	8025-8500	
16.80425-16.80475		
25.5-25.67		
37.5-38.25		
73-74.6		
74.8-75.2		
108-138		
156.52475-156.52525		
156.7-156.9		

5.5.2 Measurement Procedure

5.5.2.1 Band-edge Compliance of RF Conducted Emissions

5.5.2.1.1 Reference Level Measurement

Establish a reference level by using the following procedure:

- 1) Set instrument center frequency to DTS channel center frequency.
- 2) Set the span to ≥ 1.5 times the DTS bandwidth.
- 3) Set the RBW = 100 kHz.
- 4) Set the VBW $\geq 3 \times$ RBW.
- 5) Detector = peak.
- 6) Sweep time = auto couple.
- 7) Trace mode = max hold.
- 8) Allow trace to fully stabilize.
- 9) Use the peak marker function to determine the maximum PSD level.

5.5.2.1.2 Emissions Level Measurement

- 1) Set the center frequency and span to encompass frequency range to be measured.
- 2) Set the RBW = 100 kHz.
- 3) Set the VBW $\geq 3 \times$ RBW.
- 4) Detector = peak.
- 5) Ensure that the number of measurement points \geq span/RBW
- 6) Sweep time = auto couple.
- 7) Trace mode = max hold.
- 8) Allow trace to fully stabilize.
- 9) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

5.5.2.2 Conducted Spurious Emissions

Set the spectrum analyzer as follows:

- 1) Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.

Typically, several plots are required to cover this entire span.

- 2) RBW = 100 kHz
- 3) VBW \geq RBW
- 4) Sweep = auto
- 5) Detector function = peak
- 6) Trace = max hold
- 7) Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
- 8) Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

5.5.2.3 Radiated Spurious Emissions

- 1) The preliminary and final radiated measurements were performed to determine the frequency producing the maximum emissions in at a 10m semi-anechoic chamber. The EUT was tested at a distance 3 meters.
- 2) The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
- 3) The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1 000 MHz using the Bi-Log antenna, and from 1 000 MHz to 26 500 MHz using the horn antenna.
- 4) Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
- 5) The 0.8m height is for below 1 G testing, and 1.5m is for above 1G testing.

Note

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.
The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1 kHz ($\geq 1/T$) for Average detection (AV) at frequency above 1 GHz. (where T = pulse width)

5.5.3 Test Result

- Complied

- Conducted Spurious Emissions was shown in figure 3.
Note: We took the insertion loss of the cable into consideration within the measuring instrument.
- Measured value of the Field strength of spurious Emissions (Radiated)
- It tested x,y and z – 3 axis each, mentioned only worst case data at this report.

- Below 1 GHz data (worst-case)

Middle Channel (2 440 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 MHz										
2.88	9	H	36.10	0.56	-32.71	19.65	-12.50	23.60	69.50	45.90
27.25	9	V	35.70	1.11	-32.68	19.07	-12.50	23.20	69.50	46.30
Above 29.00	Not Detected	-	-	-	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz										
179.87	120	H	51.60	3.00	-32.49	9.59	-19.90	31.70	43.50	11.80
299.66	120	H	46.80	3.84	-32.53	13.59	-15.10	31.70	46.00	14.30
599.39	120	H	44.10	5.98	-32.87	19.29	-7.60	36.50	46.00	9.50
659.41	120	H	41.90	6.28	-32.86	19.48	-7.10	34.80	46.00	11.20
Above 700.00	Not Detected	-	-	-	-	-	-	-	-	-

Factor = Cable loss + Amp gain + Antenna factor

- Above 1 GHz data

Lowest Channel (2 402 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 995.31	1 000	V	78.50	4.49	-62.71	30.92	-27.30	51.20	74.00	22.80
2 310.94 ¹⁾	1 000	H	66.40	4.74	-61.26	31.42	-25.10	41.30	74.00	32.70
2 793.44	1 000	H	69.80	5.10	-61.99	32.19	-24.70	45.10	74.00	28.90
3 989.38	1 000	H	71.90	5.91	-62.04	32.63	-23.50	48.40	74.00	25.60
5 584.38	1 000	H	67.50	6.88	-62.60	35.32	-20.40	47.10	74.00	26.90
18 421.81	1 000	H	48.10	12.60	-51.80	44.20	5.00	53.10	74.00	20.90
25 996.38	1 000	V	46.20	14.90	-52.00	46.40	9.30	55.50	74.00	18.50
Above 26 000.00	Not Detected	-	-	-	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz										
1 995.31	1 000	V	67.10	4.49	-62.71	30.92	-27.30	39.80	54.00	14.20
2 310.94 ¹⁾	1 000	H	55.10	4.74	-61.26	31.42	-25.10	30.00	54.00	24.00
2 793.44	1 000	H	60.10	5.10	-61.99	32.19	-24.70	35.40	54.00	18.60
3 989.38	1 000	H	63.40	5.91	-62.04	32.63	-23.50	39.90	54.00	14.10
5 584.38	1 000	H	61.70	6.88	-62.60	35.32	-20.40	41.30	54.00	12.70
18 421.81	1 000	H	36.70	12.60	-51.80	44.20	5.00	41.70	54.00	12.30
25 996.38	1 000	V	34.50	14.90	-52.00	46.40	9.30	43.80	54.00	10.20
Above 26 000.00	Not Detected	-	-	-	-	-	-	-	-	-

¹⁾ Restricted band

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**Middle Channel (2 440 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 678.75	1 000	H	74.00	4.07	-63.69	30.12	-29.50	44.50	74.00	29.50
1 995.00	1 000	V	80.00	4.49	-62.71	30.92	-27.30	52.70	74.00	21.30
2 793.44	1 000	H	70.30	5.10	-61.99	32.19	-24.70	45.60	74.00	28.40
3 989.38	1 000	H	73.30	5.91	-62.04	32.63	-23.50	49.80	74.00	24.20
5 187.44	1 000	H	66.50	6.67	-62.06	35.29	-20.10	46.40	74.00	27.60
18 418.62	1 000	V	47.80	12.60	-51.80	44.20	5.00	52.80	74.00	21.20
25 996.38	1 000	H	47.40	14.90	-52.00	46.40	9.30	56.70	74.00	17.30
Above 26 000.00	Not Detected	-	-	-	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz										
1 678.75	1 000	H	69.20	4.07	-63.69	30.12	-29.50	39.70	54.00	14.30
1 995.00	1 000	V	68.70	4.49	-62.71	30.92	-27.30	41.40	54.00	12.60
2 793.44	1 000	H	69.80	5.10	-61.99	32.19	-24.70	45.10	54.00	8.90
3 989.38	1 000	H	64.30	5.91	-62.04	32.63	-23.50	40.80	54.00	13.20
5 187.44	1 000	H	59.70	6.67	-62.06	35.29	-20.10	39.60	54.00	14.40
18 418.62	1 000	V	36.60	12.60	-51.80	44.20	5.00	41.60	54.00	12.40
25 996.38	1 000	H	35.20	14.90	-52.00	46.40	9.30	44.50	54.00	9.50
Above 26 000.00	Not Detected	-	-	-	-	-	-	-	-	-

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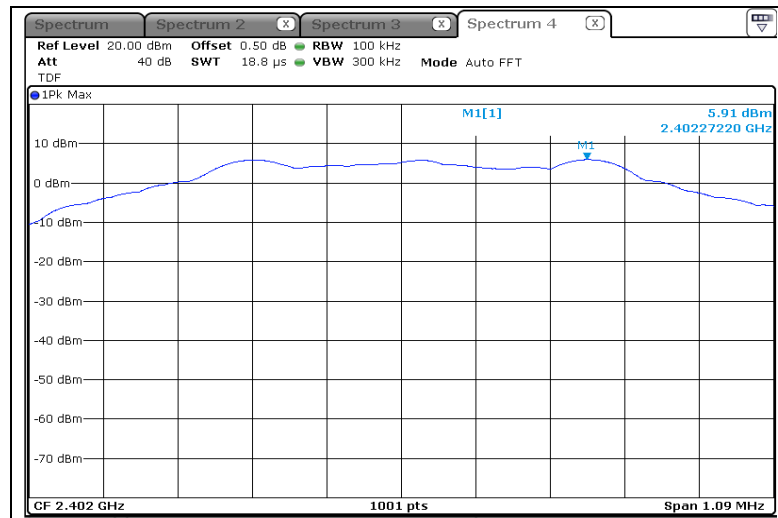
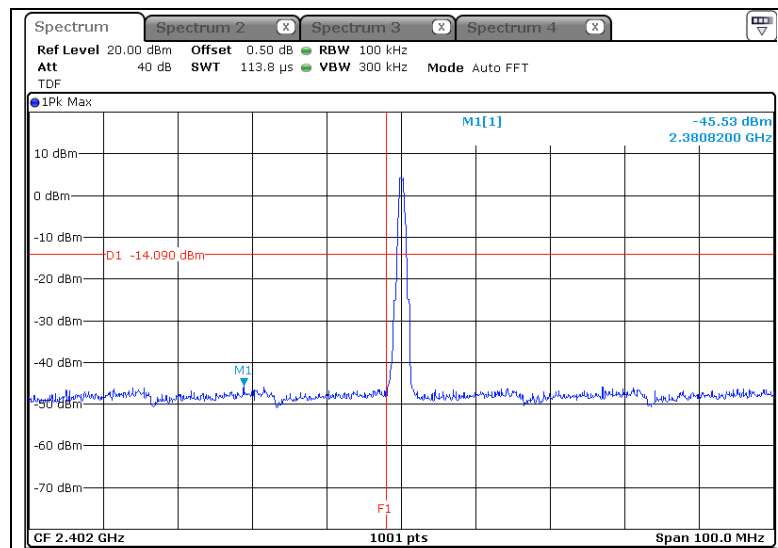
**Highest Channel (2 480 MHz)**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz										
1 995.31	1 000	V	79.90	4.49	-62.71	30.92	-27.30	52.60	74.00	21.40
2 497.50 ¹⁾	1 000	H	64.80	4.88	-61.10	31.72	-24.50	40.30	74.00	33.70
2 793.13	1 000	H	70.20	5.10	-61.99	32.19	-24.70	45.50	74.00	28.50
3 989.38	1 000	V	72.70	5.91	-62.04	32.63	-23.50	49.20	74.00	24.80
5 187.44	1 000	H	66.10	6.67	-62.06	35.29	-20.10	46.00	74.00	28.00
18 460.06	1 000	H	48.30	12.60	-51.70	44.20	5.10	53.40	74.00	20.60
25 969.81	1 000	H	45.80	14.90	-51.90	46.30	9.30	55.10	74.00	18.90
Above 26 000.00	Not Detected	-	-	-	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz										
1 995.31	1 000	V	67.90	4.49	-62.71	30.92	-27.30	40.60	54.00	13.40
2 497.50 ¹⁾	1 000	H	55.20	4.88	-61.10	31.72	-24.50	30.70	54.00	23.30
2 793.13	1 000	H	60.10	5.10	-61.99	32.19	-24.70	35.40	54.00	18.60
3 989.38	1 000	V	65.20	5.91	-62.04	32.63	-23.50	41.70	54.00	12.30
5 187.44	1 000	H	61.30	6.67	-62.06	35.29	-20.10	41.20	54.00	12.80
18 460.06	1 000	H	36.50	12.60	-51.70	44.20	5.10	41.60	54.00	12.40
25 969.81	1 000	H	35.00	14.90	-51.90	46.30	9.30	44.30	54.00	9.70
Above 26 000.00	Not Detected	-	-	-	-	-	-	-	-	-

¹⁾ Restricted band

Figure 4. Plot of the Band-edge & Conducted Spurious Emissions

Lowest Channel (2 402 MHz)

Reference**Band-edge**

Result of 2 400.0 MHz

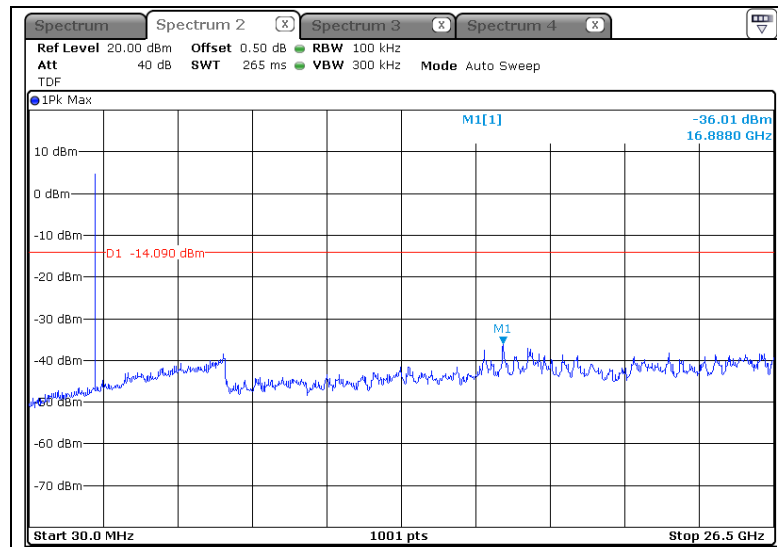
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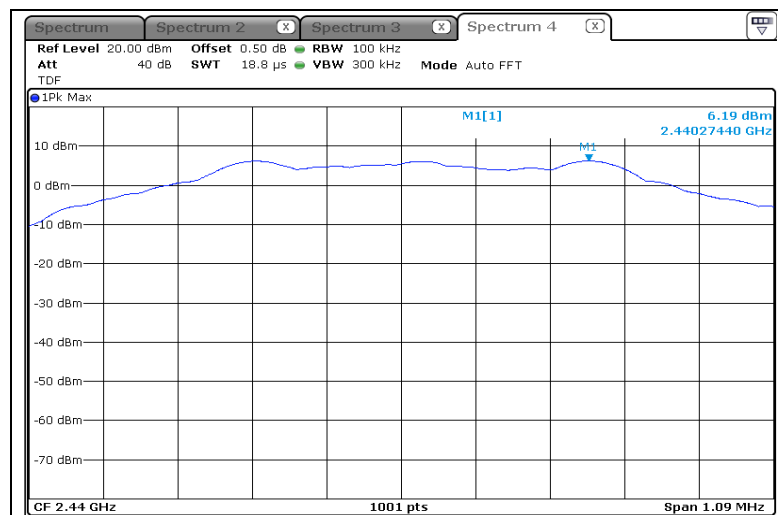
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Conducted Spurious Emissions



Middle Channel (2 440 MHz)

Reference



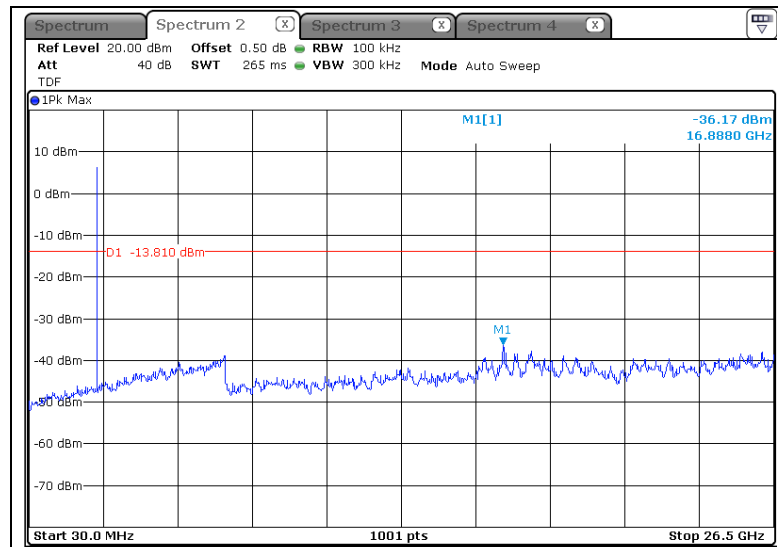
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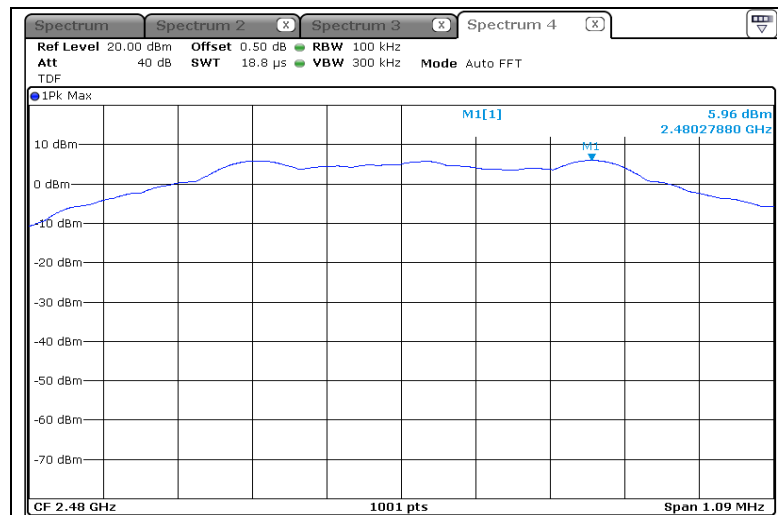
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Conducted Spurious Emissions



Highest Channel (2 480 MHz)

Reference



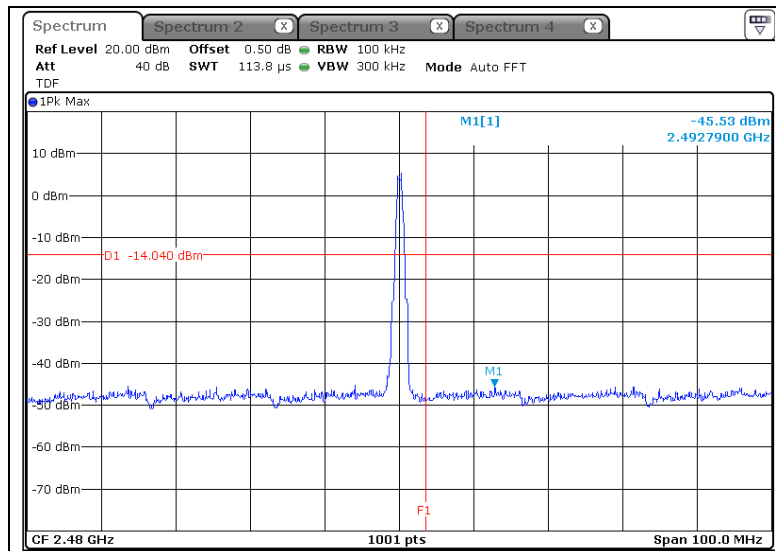
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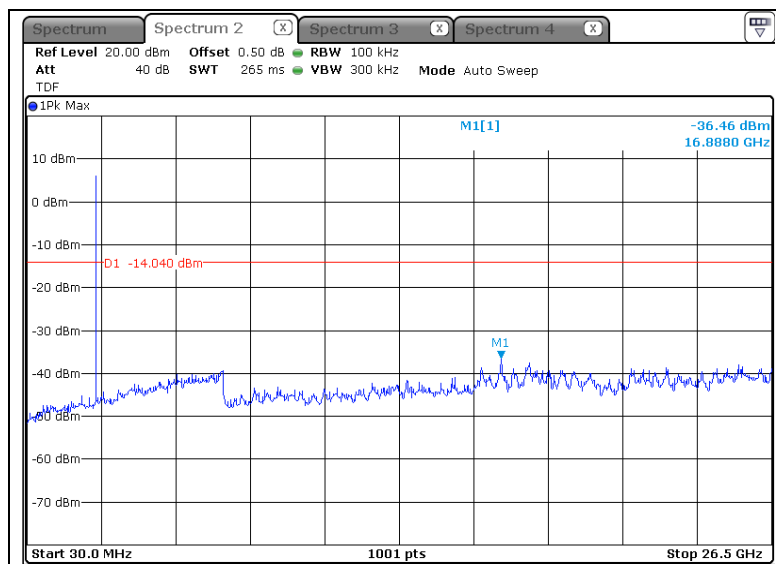
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Band-edge



Result of 2 483.5 MHz

Conducted Spurious Emissions



5.6 Conducted Emission

5.6.1 Regulation

5.6.1.1 Regulation for FCC

According to §15.207(a), 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, as measured using a 50 µH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

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.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

5.6.1.2 Regulation for IC

According to § RSS GEN Issue 4, 8.8, A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz -30 MHz, shall not exceed the limits in Table 3.

Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 3 below. The more stringent limit applies at the frequency range boundaries.

The conducted emissions shall be measured in accordance with the reference publication mentioned in Section 3.

Frequency (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average **
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* The level decreases linearly with the logarithm of the frequency.

** A linear average detector is required.

5.6.2 Measurement Procedure

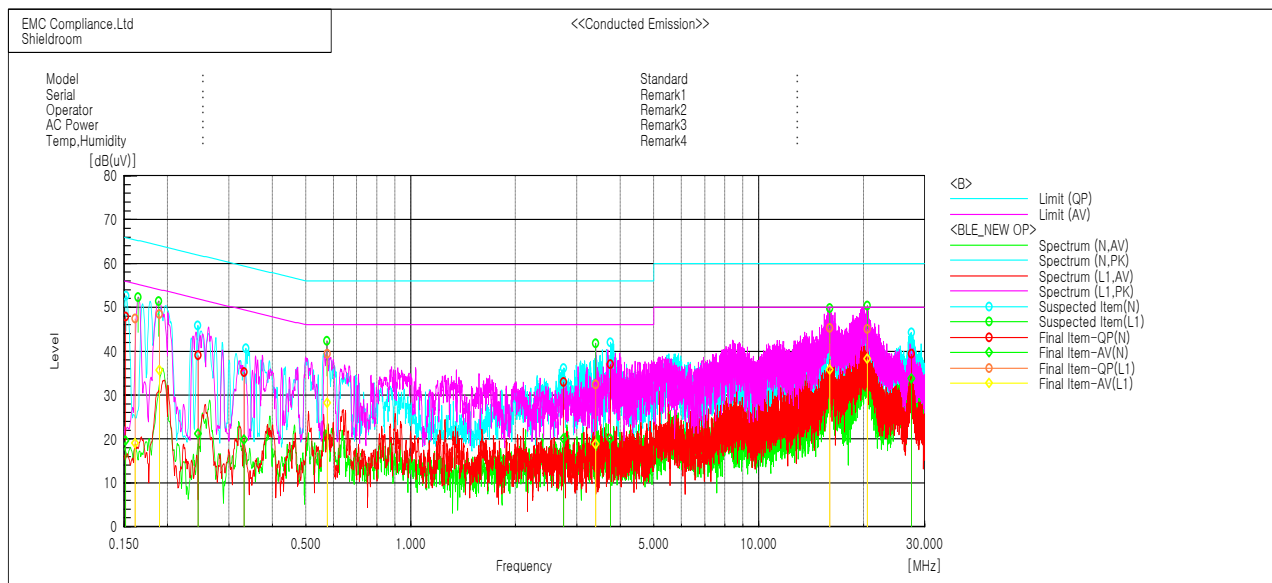
- 1) The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
- 2) Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, 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 in 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 amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

5.6.3 Test Result

- Complied

Figure 4. plot of Conducted Emission

- Conducted worst-case data : Middle Channel (2 440 MHz)



Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.15155	38.1	9.8	9.8	47.9	19.6	65.9	55.9	18.0	36.3
2	0.24503	29.3	11.4	9.7	39.0	21.1	61.9	51.9	22.9	30.8
3	0.33177	25.4	10.0	9.8	35.2	19.8	59.4	49.4	24.2	29.6
4	2.74796	23.1	10.2	9.8	32.9	20.0	56.0	46.0	23.1	26.0
5	3.750	27.2	10.2	9.8	37.0	20.0	56.0	46.0	19.0	26.0
6	27.51001	29.1	23.6	10.2	39.3	33.8	60.0	50.0	20.7	16.2

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.16136	37.4	9.0	10.0	47.4	19.0	65.4	55.4	18.0	36.4
2	0.1894	38.4	25.6	10.0	48.4	35.6	64.1	54.1	15.7	18.5
3	0.57591	29.4	18.2	9.9	39.3	28.1	56.0	46.0	16.7	17.9
4	3.39853	22.5	9.0	9.8	32.3	18.8	56.0	46.0	23.7	27.2
5	16.01304	35.2	25.8	10.0	45.2	35.8	60.0	50.0	14.8	14.2
6	20.53727	35.0	28.3	10.0	45.0	38.3	60.0	50.0	15.0	11.7

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6. Test equipment used for test

	Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
■	Spectrum Analyzer	R & S	FSV40	100989	17.01.07
■	DC Power Supply	Agilent	E3632A	KR75304571	17.07.07
■	Signal Generator	R & S	SMR40	100007	17.06.02
■	Wideband Power Sensor	R & S	NRP-Z81	102398	17.02.11
■	ATTENUATOR	HP	8491A	29738	17.01.07
■	EMI TEST RECEIVER	R & S	ESCI	100732	17.08.25
■	TWO-LINE V-NETWORK	R & S	ENV216	101352	17.08.26
■	Bi-Log Antenna	SCHWARZBECK	VULB 9163	552	18.06.27
■	Amplifier	SONOMA INSTRUMENT	310N	186280	17.04.07
■	Attenuator	SCHWARZBECK	DGA9552N	BU2404	17.04.08
■	Horn antenna	ETS.lindgren	3116	00086635	17.05.03
■	Horn antenna	ETS.lindgren	3117	161225	17.05.03
■	AMPLIFIER	L-3 Narda-MITEQ	AMF-7D-01001800-22-10P	2003683	17.08.26
■	AMPLIFIER	L-3 Narda-MITEQ	JS44-18004000-33-8P	2000996	17.08.26
■	LOOP Antenna	R & S	HFH2-Z2	100355	18.03.03
■	Antenna Mast	MATURO	AM4.0	079/3440509	-
■	Turn Table	MATURO	CO2000-SOFT	-	-
■	Highpass Filter	WT	WT-A1698-HS	WT160411001	17.07.08
■	Vector Signal Generator	R & S	SMBV100A	257566	17.01.07
■	Cable Assembly	HUER+SUHNER	SUCOFLEX 102	MY3571/2	-